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MAY
1957

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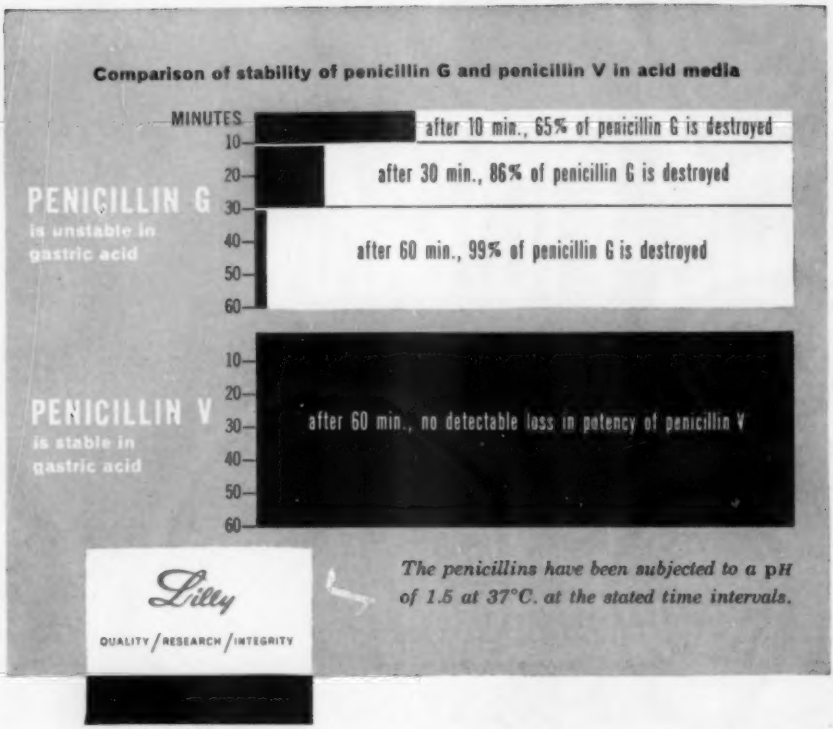
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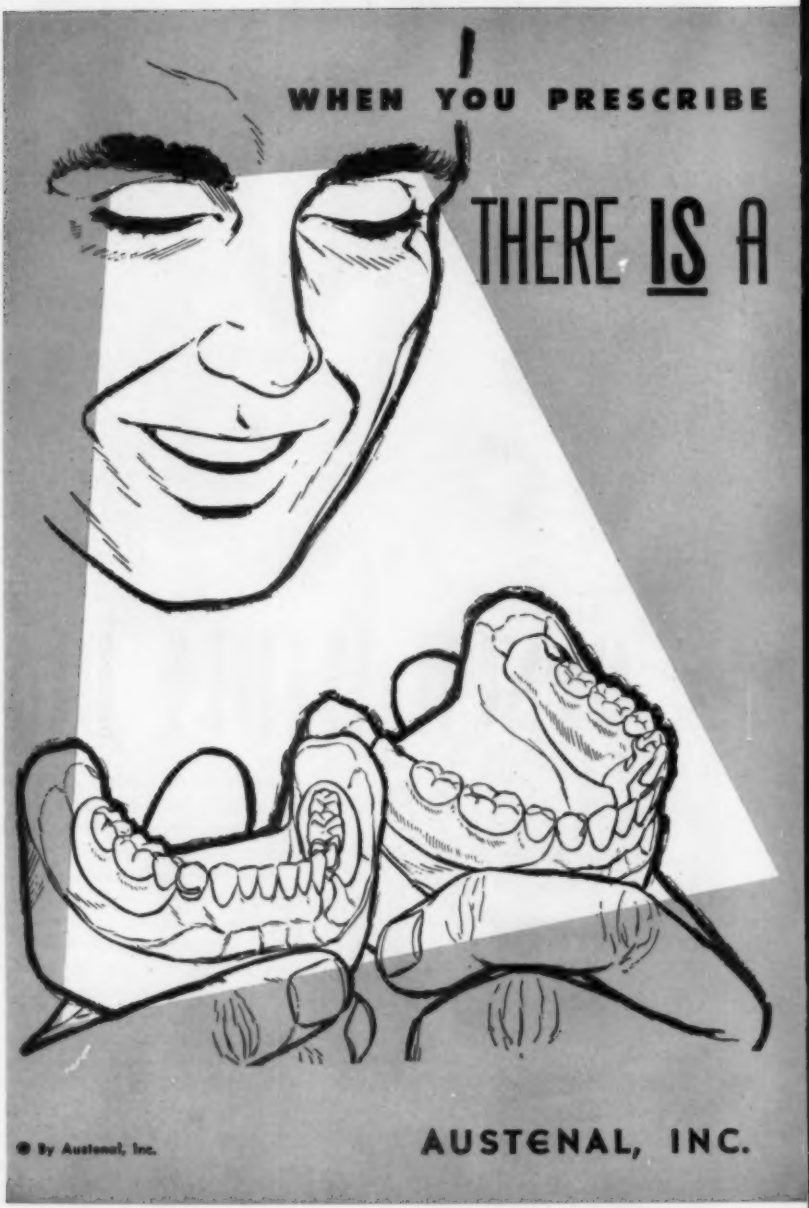
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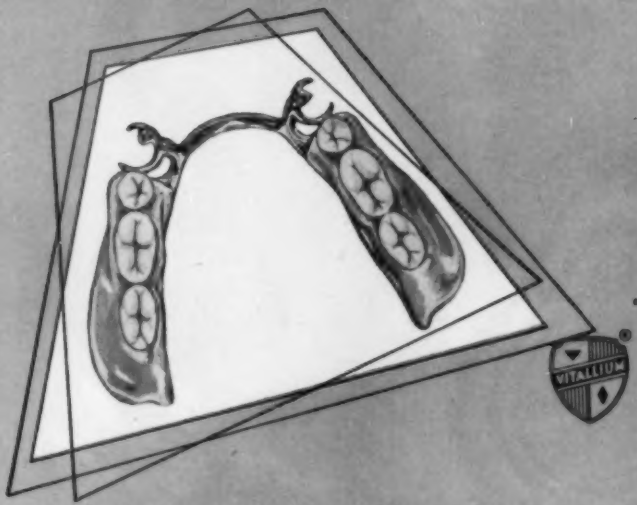

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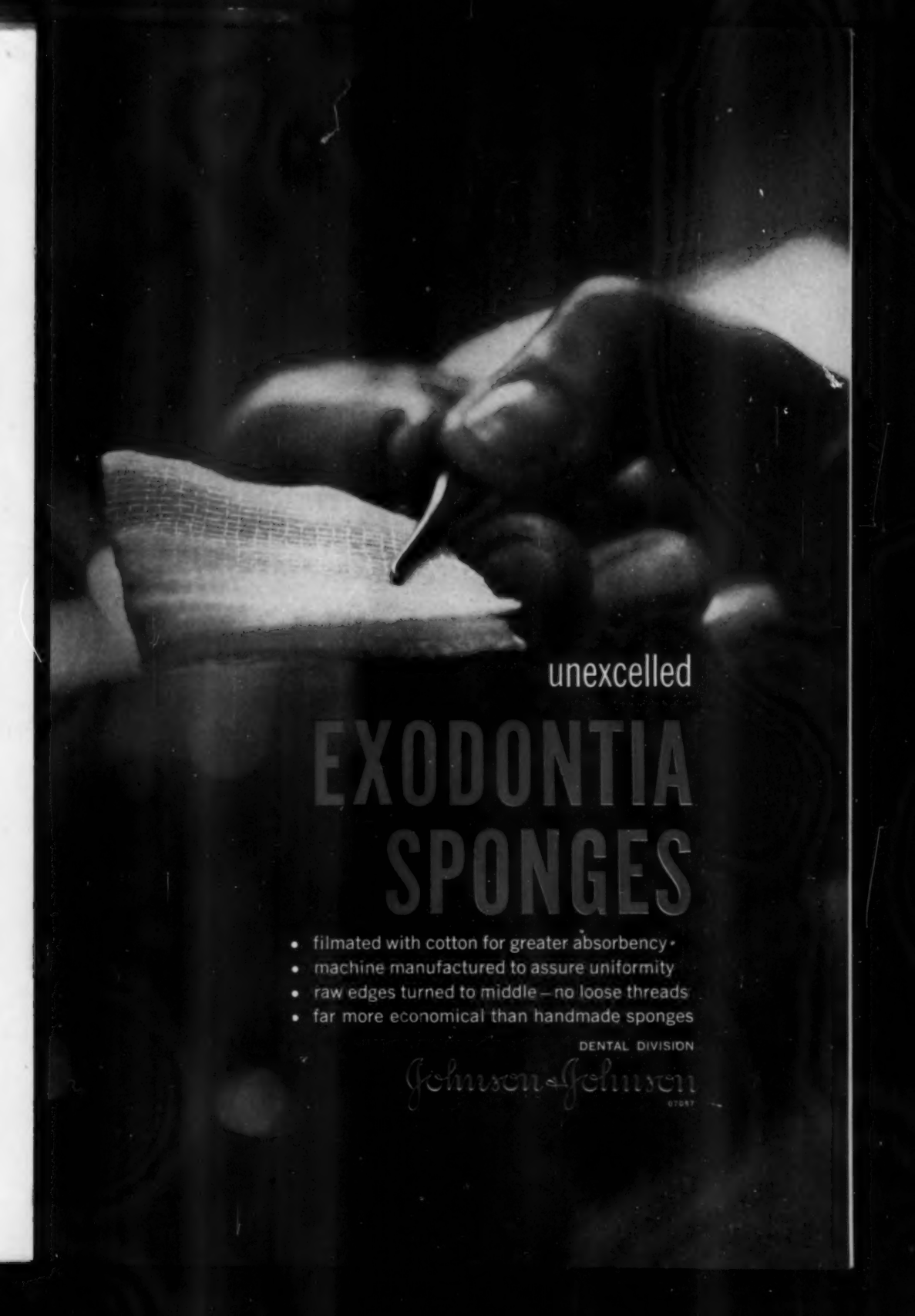
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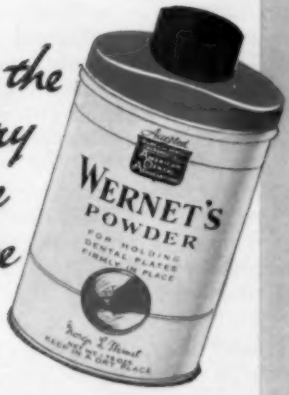

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MAY, 1957

Sensitive teeth are not one of the ills attributable to modern diets. Versalius, in the 16th century, found cause for consolation: "The Almighty Artificer . . . bestowed the noteworthy faculty of sensation on the teeth alone among the rest of the bones. For He knew that they will frequently encounter objects which might cut, break or scratch them, unduly heat or chill them. . . . Consequently, had they no power of sensation, man would not be warned by pain and would not protect the tooth . . ."

• • •

Dentifrices — or what the ancients classed as dentifrices — included an awesome and fascinating variety, according to Pliny the Elder. The Roman who brushed once, twice or three times a day had these choices: snail shells, ashes of burnt heads of hares, wolves or mice, goat's milk and bull's gall, plaintain and birthwort, elephant-tusk filings or egg shells with the inner membrane removed.

• • •

Dentists of the 18th and 19th centuries in India used an instrument called a *Dantalekhana* for removing tartar from the teeth. Traditionally, it was to be "made by a skilled smith, sharp enough to split a hair . . . of beautiful form, convenient to hold, and of the color of the blue lotus." 20th century India is the source of another interesting dental item, Gum Karaya. This, too, produced by skilled artisans, is "convenient to hold" . . . as the principal ingredient of Wernet's Powder, to hold dentures.

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A Mayan ceremonial mask now in the Prehistoric Museum in Rome, Italy reveals Central American artisans as meticulous craftsmen and capable of recording human features realistically. As an object of beauty, the mask is valued for its intricate inlays of turquoise and sea shells, but of special interest to the dental historian are its exposed and carved complete sets of teeth. These are not only anatomically correct but also articulated, showing the curve of Spee.

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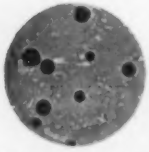

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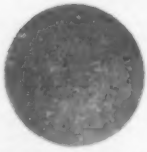

Note in these two photomicrographs how the denser, more homogenous structure of vacuum fired porcelain is substantially free from the voids and bubbles found in conventional porcelain.

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MAY 1957 VOLUME 54 • NUMBER 5

THE Journal OF THE AMERICAN DENTAL ASSOCIATION

Caries-inhibiting value of a dentifrice containing stannous fluoride: first year report of a supervised toothbrushing study

William A. Jordan, D.D.S., M.P.H., and*
John K. Peterson,† D.D.S., M.P.H., Minneapolis

The possible value of stannous fluoride as an anticariogenic agent has been studied for some time. It has been shown to be more effective than sodium fluoride for reducing enamel solubility *in vitro*,[1,2] for reducing dental caries in rats[3-5] and hamsters,[6] and for reducing dental caries in children after topical treatment.[7-9] Moreover, stannous fluoride combined with a compatible abrasive (calcium pyrophosphate) in a dentifrice has already shown an encouraging effectiveness in decreasing dental caries in children and adults.[10-13] Additional clinical studies are needed to verify the results of the dentifrice studies by Muhler and associates. The clinical evaluation study at Bloomington, Minn., has been set up to obtain more information concerning the value of a stannous fluoride-containing dentifrice.

PROCEDURE

Included in the study were 628 children who were in the third and fourth grades at the time of the initial examination in May 1955 and whose parents signed authorizations for participation. These

*Chief, section of dental health, Minnesota Department of Health.

†Assistant chief, section of dental health, Minnesota Department of Health.

1. Van Huysen, G., and Muhler, J. C. Enamel solubility reducing effect of flavored low concentration stannous fluoride solution. J. D. Res. 27:46 Feb. 1948.

2. Muhler, J. C., and Day, H. G. Relation of pH to the effectiveness of sodium fluoride and stannous fluoride in decreasing enamel solubility. J. D. Res. 31:102 Feb. 1952.

3. Muhler, J. C., and Day, H. G. Effects of stannous fluoride, stannous chloride and sodium fluoride on the incidence of dental lesions in rats fed a caries-producing diet. J.A.D.A. 41:528 Nov. 1950.

4. Muhler, J. C., and Day, H. G. Effect of stannous fluoride in food and in drinking water on caries prevention in rats on high sucrose and coarse corn diets. J. Nutrition 44:413 July 1951.

children (ages 8 to 11) all received dental examinations by a single examiner with the aid of a portable dental chair, explorers, and a Burton mouth light. Each sound, carious, filled or missing permanent tooth and surface was recorded in code on an examination form designed for the base line and two subsequent examinations. (At the time of the second examination, the first year data on the form were masked to prevent possible unconscious examiner bias in diagnosing.) Two posterior and three anterior bitewing roentgenograms were taken of each child. Any carious surfaces which were subsequently found by the roentgenographic examination were added to the examination forms.

The dentifrice was supplied to the children in plain tubes, with only the label "E" or "H" appearing on the carton. The two dentifrices appeared to be identical in taste, consistency and appearance. They differed only in that one contained 0.4 per cent stannous fluoride and 1 per cent stannous pyrophosphate and had a pH of 4.9; the pH of the control paste was 6.8. The slightly soluble stannous pyrophosphate furnished a reservoir of stannous ions to replace those, derived from stannous fluoride, that may have been inactivated by reaction with other constituents of the formulation. Laboratory evidence[14] indicated that a pH of around 5.0 was most likely to be suitable from the standpoints of stability and effectiveness of stannous fluoride, but that this degree of acidity in a control dentifrice (without stannous fluoride) could introduce a real danger to dental enamel under usage conditions.

The identity of the dentifrice containing the stannous fluoride was unknown to the authors until after the first year anniversary examinations were completed. A sealed letter supplied by the manufacturer and stating the composition (Table 1) of the two dentifrices was opened after the completion of the examinations and the tabulation of data. These formulas are the same as those of the dentifrices tested previously[10-13] with the exception that the "H" dentifrice contained 1 per cent stannous pyrophosphate.

The children at one school received the stannous fluoride dentifrice, whereas those at the other school received the control. The principals at the two schools selected the dentifrice for their schools by the flip of a coin. Each child was given a toothbrush and his designated dentifrice in May 1955 for summer use. More dentifrice was always available at the schools and the children were encouraged to take enough to supply their whole family. The children were shown the proper toothbrushing technic and encouraged to brush their teeth routinely after each meal at home. During the school year 1955-1956 they brushed their teeth under supervision once a day after the noon meal in school.

The relative effectiveness of the "E" and "H" dentifrices and consequently the dentifrice containing 0.4 per cent stannous fluoride was measured by the com-

5. Muhler, J. C.; Nebergall, W. H., and Day, H. G. Preparations of stannous fluoride compared with sodium fluoride for the prevention of dental caries in the rat. J.A.D.A. 46:290 March 1953.

6. Radike, A. W., and Muhler, J. C. Incidence of dental caries in hamsters receiving two different water-soluble fluorides at low concentrations. J. D. Res. 32:807 Dec. 1953.

7. Howell, C. L., and others. Effect of topically applied stannous fluoride on dental caries experience in children. J.A.D.A. 50:14 Jan. 1955.

8. Slack, G. L. Effect of topical application of stannous fluoride solution in the prevention of dental caries. J. D. Res. (Abst.) 34:785 Oct. 1955.

9. McLaren, H. R., and Brown, H. K. A study of the use of a topically applied stannous fluoride solution in the prevention of dental caries. Canadian J. Pub. Health 46:387 Oct. 1955.

10. Muhler, J. C., and others. The effect of a stannous fluoride-containing dentifrice on caries reduction in children. J. D. Res. 33:606 Oct. 1954.

11. Muhler, J. C.; Radike, A. W.; Nebergall, W. H., and Day, H. G. Effect of a stannous fluoride-containing dentifrice on caries reduction in children. II. Caries experience after one year. J.A.D.A. 50:163 Feb. 1955.

12. Muhler, J. C.; Radike, A. W.; Nebergall, W. H., and Day, H. G. The effect of a stannous fluoride-containing dentifrice on dental caries in adults. J. D. Res. 35:49 Feb. 1956.

13. Muhler, J. C., and others. A comparison between the anticariogenic effects of dentifrices containing stannous fluoride and sodium fluoride. J.A.D.A. 51:556 Nov. 1955.

14. Radike, A. W. Personal communication.

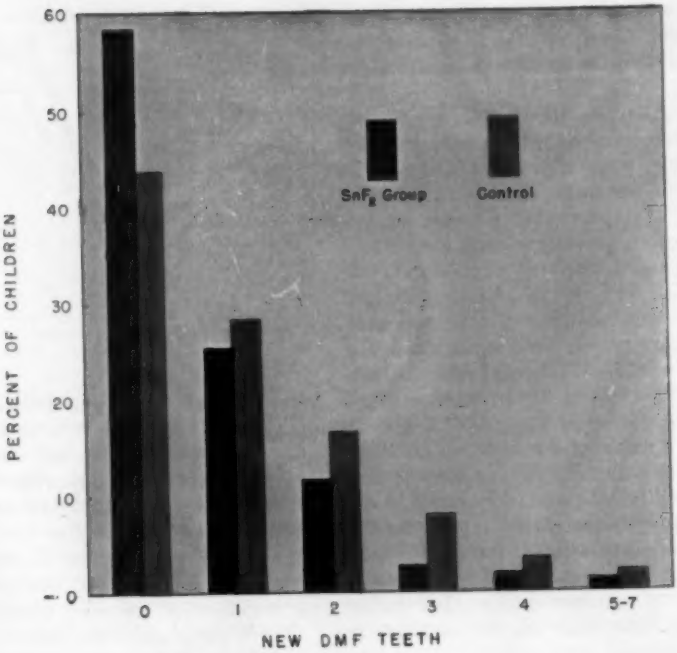

Fig. 1 • Percentage of children with 0-7 new DMF teeth

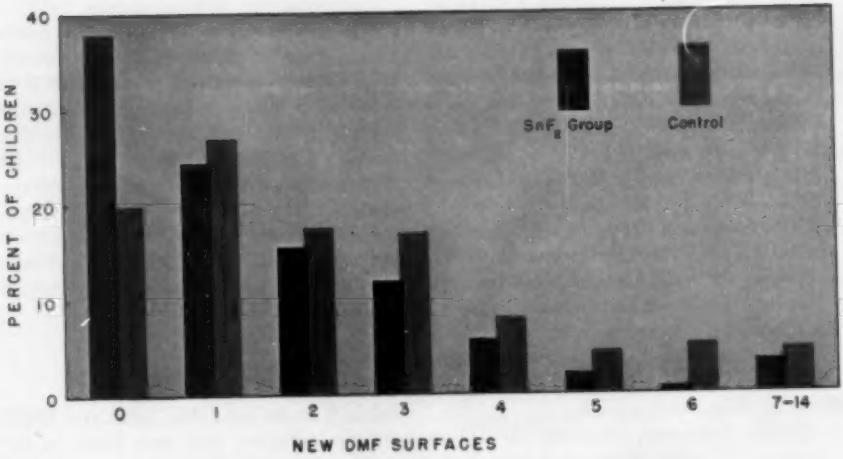

Fig. 2 • Percentage of children with 0-14 new DMF surfaces

parative incidence of new carious teeth and tooth surfaces in the study and control children during the first year of the study.

A smaller group of children in two other Bloomington schools were included in another phase of the study. These children did not brush their teeth while in school. The children were paired according to caries prevalence, with each school having equal numbers of children using "E" and "H" dentifrice. Dentifrice and brushes were sent home with these children. This report does not include the data from these children because distribution procedures in these schools resulted in a possible exchange of dentifrice among an unknown number of children. Fewer than the expected number of new DMF teeth and surfaces appeared to develop in both the study and control groups. This is questionable and unmeasurable, however, because of the failure of a large number of roentgenograms taken during the last two days of the anniversary examinations.

Table 1 • Composition of the dentifrices

Composition	Dentifrice "E" per cent	Dentifrice "H" per cent
Heat-treated calcium orthophosphate	40.00	39.00
Detergent (non-soap)	1.51	1.51
Humectant	30.00	30.00
Bender	1.50	1.50
Stannous pyrophosphate	——	1.00
Minor ingredients (flavor, etc.)	1.44	1.62
Stannous fluoride	——	0.40
Water	25.55	24.97
pH*	6.8	4.9

*As measured in 25 per cent slurries.

COMPARABILITY OF STUDY GROUPS

Bloomington, Minn., is a rapidly-expanding suburban community that has grown from 3,500 to 35,000 people in ten years. The large majority of the homes are less than ten years old and are in the 10 to 15 thousand dollar class. Consequently most of the children are from the same economic level and lead a similar way of life.

The data from the May 1955 base line examinations demonstrate the similarity between the study and control groups. The distribution of children according to number, age and sex is listed in Table 2. The groups were similar with the exception of a somewhat larger percentage of boys in the control school.

DMF (decayed, missing or filled permanent) tooth and surface prevalence was determined for each group. Since the relative number of children in each age group was the same for the study group and the control group, the data were grouped without age-adjusting. Table 3 shows the similarity of DMF teeth and DMF surface data in the two groups. There was no statistical difference in caries prevalence in the two groups at the beginning of the study program.

There was a loss of 63 children (20 per cent) in the study group and 60 children (19 per cent) in the control group during the first year of the study. A comparison of the initial DMF prevalence of the remaining children showed no significant change from the original groups.

The amount of dentifrice used at home by the families of the study and control children was estimated in October 1955 by sending home a questionnaire at the beginning and end of the month. The families reported 0.34 tubes of dentifrice used per person during October for the study group, and 0.36 tubes per person for the control group. The difference is not significant, so the two groups were considered to use comparable amounts of the dentifrice.

RESULTS AND DISCUSSION

Table 4 shows the DMF teeth and DMF surface incidence that took place in the study (stannous fluoride) and control groups during the calendar year ending in

Table 2 • Distribution of children by age and sex, May 1955

Age	Study group				Control group			
	Boys	Girls	Total	Per cent of total	Boys	Girls	Total	Per cent of total
8	62	73	135	43.4	83	58	141	44.5
9	62	61	123	39.5	67	58	125	39.4
10	26	24	50	16.1	28	20	48	15.1
11	2	1	3	1.0	2	1	3	.9
Total	152	159	311		180	137	317	
Per cent of total	48.9	51.1			56.8	43.2		

May 1956. There were 35 per cent fewer DMF teeth developed in the group using the stannous fluoride dentifrice than developed in the control group. When the DMF surfaces index is used as a method of comparison, the reduction for the group using the stannous fluoride dentifrice is 34 per cent. Both these reductions are statistically significant as indicated by their low probabilities. These findings are similar to those reported by Muhler and co-workers[11, 18] after one year of unsupervised use of a stannous fluoride dentifrice.

There was a greater reduction in the incidence of caries on less susceptible surfaces (Table 5). The greatest reduction occurred on the buccolingual surfaces (41 per cent) and the least on the occlusal surfaces (23 per cent). This does not necessarily mean that the stannous fluoride dentifrice gives greater protection to some surfaces. The more susceptible surfaces (occlusal and proximal) probably need more protection than the buccal and lingual to prevent the incidence of caries.

Fifty-nine per cent of the children in the group using the stannous fluoride dentifrice, in contrast to 44 per cent of the children in the control group, did not develop new DMF teeth. The probability of this occurring by chance is .001. Correspondingly larger numbers of children in the control group developed 1 to 7 DMF teeth (Fig. 1). The same pattern (Fig. 2) occurred in the incidence of DMF surfaces, where 38 per cent of the study group and 20 per cent of the control group did not develop new DMF surfaces. This difference has a probability of less than .0001.

The study dentifrice contained 0.4 per cent stannous fluoride. This is a fluoride concentration of 1,000 ppm. Each home and school in Bloomington has its own well to supply water. Samples taken in four scattered locations showed a fluoride content of .09 to .11 ppm. In January 1956, urine samples were obtained from 40 boys in each group to determine if there was any change in the urine fluoride level from incidental swallowing of the fluoride dentifrice during toothbrushing.

Table 3 • DMF teeth and surfaces, initial examination

Group	Number of children	Mean DMF teeth	Standard error	Mean DMF surfaces	Standard error
Study	248	3.67	0.125	6.20	0.267
Control	257	3.58	0.129	6.24	0.298

Table 4 • Mean DMF incidence, May 1955-May 1956

Group	No. of children	DMF teeth incidence		DMF surfaces incidence	
		Mean	Standard error	Mean	Standard error
Study ($Sn F_2$)	248	0.673	.066	1.488	.113
Control	257	1.043	.077	2.253	.134
Per cent reduction		35.47		33.95	
Probability		<.001		<.0001	

The average fluoride concentration in the urine of the boys using the stannous fluoride-containing dentifrice was 0.198 ppm, whereas the corresponding fluoride concentration from the boys using the stannous fluoride-free control dentifrice was 0.196 ppm. These concentrations were remarkably close, and indicate that there was no increase in the urinary fluoride level resulting from the use of the study dentifrice. These findings corroborate previous work by Schweinsberger and Muhler.[15]

The prevalence of stained teeth in the children using both dentifrices was recorded at the time of the second examination. Forty children had noticeably stained teeth in the stannous fluoride group, and 45 were found with similar staining in the control group. This staining was typical of that found on surfaces that are not self-cleansing in mouths with poor oral hygiene. Casual observations rather than rigid criteria were used in diagnosing "stained teeth."

Five hundred and five, fourth and fifth grade children, equally divided between two elementary schools, provided the control and study groups for the clinical evaluation of a 0.4 per cent stannous fluoride dentifrice. The children in both schools were comparable in age, sex and caries prevalence. Children in both schools brushed their teeth once a day in school after the noon meal, and also received dentifrice and brushes for home care. A mid-year study determined that comparable amounts of dentifrice were being used at home by each group.

The children in the school who used the stannous fluoride-containing dentifrice developed 35 per cent fewer DMF teeth and 34 per cent fewer DMF surfaces than the control children during the first year of the study. These reductions are statistically significant.

A urinalysis in January 1956 showed no elevation in fluoride content in the group using the stannous fluoride-containing dentifrice when compared with the control.

No difference in the prevalence of stain was found in either the stannous fluoride or control group.

The first year results from the use of this stannous fluoride-containing dentifrice at Bloomington, Minn., corroborate the original work by Muhler and associates in Indiana and show the effectiveness and safety of stannous fluoride used in an abrasive-compatible dentifrice for one year.

15. Schweinsberger, R. A., and Muhler, J. C. Urinary fluorine levels following the clinical use of a stannous fluoride-containing dentifrice. (Abst.) J. D. Res. 34:726 Oct. 1955.

Table 5 • Mean DMF surfaces incidence, May 1955-May 1956

	Number of children	Mean DMFS incidence			
		Proximal	Occlusal	Buccolingual	Total
Study group ($Sn F_2$)	248	.762	.403	.323	1.488
Control group	257	1.187	.521	.545	2.253
Per cent reduction		35.8	22.7	40.7	34.0
Probability		<.001	<.11	<.003	<.0001

Histologic comparison of two pulp capping agents

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When a vital dental pulp is exposed through operative procedures, there are four possible methods of treatment: (1) pulp capping; (2) pulpotomy; (3) root canal therapy, and (4) tooth extraction. The obligation of the dentist is to maintain the oral structures in as ideal a state of health, function, esthetics and comfort as possible. Thus, if a vital dental pulp has been exposed through operative procedures, the most conservative method of treatment, pulp capping, should be considered first.

In order to qualify for pulp capping, the tooth must be asymptomatic and without a history of spontaneous or intermittent pain. The exposure must have been made in a dry field with clean instruments. The tooth must be vital as evidenced by hemorrhage on exposure. The exposure itself must be petechial, preferably, not exceeding 1 mm. in diameter.

If these minimum requirements are satisfied, a capping agent should be selected that can be placed over the exposure without causing pressure on the pulp tissue. In addition, this agent should be relatively nonirritating, preferably bactericidal but at least bacteriostatic, and should encourage the formation of a hard tissue bridge over the exposure.

The most commonly used pulp capping agents are the following: (1) zinc oxide and eugenol, or preparations that are basically composed of these two materials, and (2) calcium hydroxide either by itself or as the basic ingredient of various commercial preparations.

Glass and Zander[1] have demonstrated histologically, on human teeth, the superiority of calcium hydroxide over zinc eugenate as a capping agent. Since their work, many commercial preparations have been placed on the market. Among these is a product containing calcium hydroxide, zinc oxide, iodoform, phenol and eugenol. Since the clinical trial of this combination of drugs was reported as giving success in 87 per cent of 243 pulps capped,[2] it was decided to determine, histologically, what effect this material had on the pulps of teeth in dogs.

Using the work of Glass and Zander as a base line, experimental procedure was designed to compare the effect of the mixture with pure calcium hydroxide on the vital pulps of dogs' teeth. Preliminary examination revealed that calcium hydroxide has a pH of 11.3, whereas the experimental material recorded a pH of

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1. Glass, R. L., and Zander, H. A. Pulp healing. J. D. Res. 28:97 April 1949.

2. Wittich, Harold C. Preliminary report on the use of capping preparations. North-West Den. 31:194 Oct. 1952.

7.9. The thought was advanced that perhaps this change to a more compatible pH by the addition of other ingredients might cause less insult to the pulpal tissue while preserving the beneficial properties of the calcium hydroxide. Using variable proportions of the constituents did not alter appreciably the pH of the mixture. Consequently, the following proportions were used for the experimental capping agent in this report:

Powder
Zinc oxide 65 per cent
Calcium hydroxide 30 per cent
Iodoform 5 per cent

Liquid
Eugenol 75 per cent
Phenol 25 per cent

TECHNIC

Three adult dogs were used as subjects. Under Nembutal (sodium pentobarbital) anesthesia the teeth were isolated with cotton rolls and the operatory site painted with tincture of Merthiolate (thimerosal). An exposure of the coronal pulp tissue through the labial surface of each of the six upper and lower anterior teeth was made approximately 1 mm. in diameter with a sterile no. 6 round bur. The cavity was kept free of debris during preparation with forced air. The vital exposed pulp tissue was covered with either a thin paste of calcium hydroxide and sterile distilled water, or a thin mixture of the experimental capping agent. The materials were alternated throughout the teeth in all three animals. The cavities were sealed with oxyphosphate of zinc cement in all instances (Fig. 1).

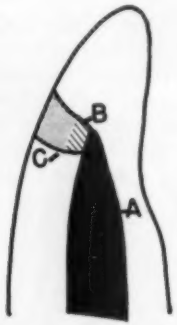

Fig. 1 • Stage of healing four weeks postoperatively. A, pulp. B, capping agent. C, oxyphosphate of zinc cement

One dog was sacrificed four weeks after the capping procedures, the second one at six weeks and the third one at eight weeks.

Under sodium pentobarbital anesthesia the teeth were extracted, ground into longitudinal slabs with a diamond disk under water, and fixed in formol-Zenker's solution. After decalcification, the teeth were sectioned and stained with hematoxylin and eosin.

RESULTS

As Glass and Zander demonstrated with human teeth, a hard tissue bridge of irregular (secondary) dentin was formed in four weeks. An area of necrosis occurred adjacent to the pulp capping agent in all instances. This necrotic area was separated from the vital pulp tissue by the irregular dentin bridge and a continuous layer of odontoblasts. The only variation in the three stages of healing was in the thickness of the irregular dentin layer. Figure 2, above left, is a representative example of the stage of healing found four weeks postoperatively with either capping agent. Figure 2, above right, represents the stage of healing observed at the eighth postoperative week. Figure 2, below, shows a higher magnification of Figure 2, above right, more clearly illustrating the area of necrosis, irregular dentin bridge and pulpal elements. At the three stages of healing observed in the microscopic sections, no distinguishable differences were observed in the capping agents used.

Fig. 2 • Above left: Stage of healing four weeks postoperatively. Above right: Stage of healing eighth postoperative week. Below: Higher magnification of view shown above right. A, area of necrosis. B, irregular dentin. C, predentin. D, odontoblasts. E, pulp tissue

CONCLUSIONS

Histologic examination of dogs' teeth whose exposed vital pulps were capped with either calcium hydroxide and distilled water, or a mixture of zinc oxide, calcium hydroxide, iodoform, phenol and eugenol, revealed no distinguishable differences in the rate of healing after from four to eight weeks, or in the results produced by either capping agent. There is no apparent advantage or disadvantage in adding zinc oxide, iodoform, phenol and eugenol to calcium hydroxide for use as a capping agent for exposed vital dental pulp tissue.

The Medical Book • The medical book is still the cornerstone of the monumental fortress of medical knowledge in our atomic age, as it was in Vesalius' time. Medicine is a science whose progress is announced in medical journals but is consolidated only in books. ***Félix Martí-Ibáñez, Books in the Physician's Life.***

Radiophosphorus uptake in chewing and nonchewing teeth

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Previous studies have indicated that the teeth of experimental animals show certain variations which may be related to the amount of chewing required by the foods eaten. Thus the molars of rats which were maintained on a liquid diet tended to show a decrease in specific gravity[1] and the molars of rhesus monkeys fed a soft diet showed a significant increase in water content.[2]

Other experiments[3] indicated that in rhesus monkeys which were made to chew unilaterally, intraperitoneally injected radioactive phosphorus was taken up to a significantly greater degree in the molars of the nonchewing side than in the molars of the chewing side of the same animal.

In the experiments mentioned, activity was measured from the enamel surface *in situ* with a small end-window counter. The limitations of this method have been pointed out.[3]

In the work described here the teeth were extracted and the radioactivity was measured first from the enamel surface. Each tooth was then digested and the radioactivity of the whole tooth determined in solution. These procedures were designed to make the measurements independent of background influences of the other oral tissues.

METHODS

In four rhesus monkeys whose ages ranged from two to four years, the left half of the dentition was put out of function in one of two ways: (1) by unilateral intracranial section of the motor division of the fifth cranial nerve (monkey N), and (2) by removal of the upper left quadrant of teeth (monkeys Q1, Q2 and Q3).

After periods of three months to three years, the monkeys were given an intraperitoneal injection of 0.5 millicurie phosphorus^{32}. Three to 28 days after P^{32} injection, the teeth were removed and the activity of left and right corresponding teeth was compared.

The teeth were scraped, scrubbed, rinsed and blotted dry, and activity was measured from the enamel surface using the small end-window counter.[3] The counter window was centered on the occlusal surface of the tooth and arranged so that all the cusps made contact with the sensitive surface. This arrangement was secured by clamps during the counting procedure. To avoid contamination, a sheet of cellophane (7/10,000 of an

This study was aided by a grant from the F. H. Fleer Corporation, Philadelphia.

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1. Neumann, H. H., and DiSalvo, N. A. Effect of disuse on the specific gravity of rat teeth. D. Items Interest 71:919 Sept. 1949.

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3. Neumann, H. H., and DiSalvo, N. A. Effect of chewing on the phosphorus exchange in teeth. J.D. Res. 33:801 Dec. 1954.

inch thick) was interposed between the window and the tooth. Repeated counts of the same specimen with dismantling and repositioning of the tooth and counter indicated an error of 10 per cent to 20 per cent in this method (average 15 per cent).

The teeth were then weighed, dried to constant weight and dissolved in a solution containing four parts concentrated hydrochloric acid and one part water. The solutions were diluted to 25 ml., and aliquots were taken for measurement of radioactivity in a well-type counter described by Veall.[4] In this counting system the activity of a fixed but unknown volume of liquid can be measured. If an absolute value for activity is required, the sample must be compared with a standard of known activity. In this experiment, however, only a comparison of activity between a functioning tooth of one side of the jaw and its nonfunctioning counterpart of the other side of the jaw was desired.

The activity is expressed in counts per minute per gram dry weight of tooth based on the activity of the unknown but fixed volume of the aliquot. Repeated counts of the same specimen yielded results which were accurate to within 1 per cent to 4 per cent (average 3 per cent).

RESULTS

In general those teeth which were put out of function took up P^{32} to a greater extent than their corresponding controls which were left in normal function. This increase in P^{32} uptake with decreased function was evident whether the activity was measured from the enamel surface or from the solutions resulting from total digestion of the teeth. The increase was more evident in the surface counts, however, where it ranged from 31 per cent to 358 per cent in eight of nine experiments (average increase 163 per cent), than in the solution counts where it ranged from 8 per cent to 77 per cent in 8 of 11 tests, the average increase being 20 per cent (see table).

In one experiment, surface activity was decreased in the nonchewing tooth by 16 per cent. In three instances, solution of the entire tooth also showed decreased activity in the nonchewing teeth of from 2 per cent to 7 per cent.

In one experiment (no. 5), the surface activity of the nonchewing tooth decreased by 25 per cent, whereas its total solution activity showed an increase of 659 per cent. This effect is considered separately because one of the specimens was unerupted and the result obtained here was quite different in degree from the others.

DISCUSSION

The magnitude of the differences and their consistency of direction indicate that a significantly greater amount of P^{32} is deposited in those teeth which do less chewing. Theoretically, this can occur either by an increase in total phosphorus content or by an increase in the rate of exchange of phosphorus atoms with their total number remaining the same, or by a combination of both.

If it is simply an increase in rate of exchange that is being dealt with, then it should be possible, by following the activity in the chewing and nonchewing tooth over a prolonged period, to demonstrate a difference in the rate of disappearance of the labeled phosphorus from the two teeth. These observations were carried out in previous experiments where unilateral chewing was produced in monkeys and surface activity was measured from the molars *in situ* at weekly intervals for periods up to 42 days after P^{32} injection.[3] A similar initial increase in

4. Veall, N. Geiger-Muller counter for measuring beta-ray activity of liquids and its application to medical tracer experiments. Brit. J. Radiol. 21:347 July 1948.

activity was noted in the teeth of the nonchewing side, but the rate of decline of activity in both chewing and nonchewing teeth was essentially the same over the 42 day period.

In the present experiments measurements were made on teeth from three to 28 days after injection of P^{32}. There is no apparent correlation between the magnitude of the difference between left and right paired teeth and the time after P^{32} injection. In general, these data tend to support the previous observations that the rate of disappearance of the labeled phosphorus is essentially the same in both the chewing and nonchewing tooth.

This leads to a consideration of the possibility of an actual increase in the total amount of phosphorus in the tooth of the nonchewing side. It is interesting to note that Le Fevre and Hodge,[5] in 1936, arrived at a somewhat similar conclusion after chemical analyses on the

5. Le Fevre, M. L., and Hodge, H. C. Are there changes in the chemical composition of human teeth due to physiological stimuli? D. Cosmos 78:1119 Nov. 1936.

Table • P^{32} uptake in chewing and nonchewing teeth

Monkey	Exp. no.	P^{32} inject., mo. after surgery	Teeth	Teeth extract., days after P^{32} inject.	Enamel surface counts per minute			Whole tooth digestion counts per minute per gram dry weight		
					L (nonchewing side)	R (chewing side)	$\frac{L-R}{R}$ % diff.	L (nonchewing side)	R (chewing side)	$\frac{L-R}{R}$ % diff.
N*	1	24	Lower first molars	6	26	13	100	217	224	−3
	2	30	Upper first molars	28	119	26	358	904	726	25
	3	33	Lower second molars	7	85	29	193	968	900	8
	4	34	Upper second molars	14	57	13	338	530	544	−2
	5†	34	Lower third molars	14	21	28	−25	1,761	232	659
	6	34	Lower second bicuspids	14	17	13	31	443	478	−7
	7	34	Upper second bicuspids	14	24	13	85	530	476	11
Q1‡	8	3	Lower first molars	3				13,130	11,580	13
	9	3	Lower decid. first & second molars	3				6,680	6,030	11
Q2‡	10	3	Lower first molars	6	69	17	306	418	236	77
	11	12	Lower second molars	7	32	38	−16	939	536	75
Q3‡	12	9	Lower first molars	7	123	71	73	2,215	1,930	15
Av.†							163			20

*Motor division of fifth cranial nerve sectioned.
†Experiment 5 is considered separately.
‡Extraction of upper left quadrant of teeth.

teeth of a human subject giving a history of unilateral chewing over a period of several years. They reported an increase in the phosphorus content in the teeth of the nonchewing side. Associated with this was an increase in the ability to absorb roentgen rays.

Whether this increase in the deposition of labeled phosphorus takes place indiscriminately throughout the entire tooth, or whether it is confined to only a part of the tooth, can be determined definitely only by adequate separation and determination of the activity in each of the dental tissues. Nevertheless, some deductions may be made from the data at hand.

A glance at the data in the table will show that the differences were more noticeable when enamel surface activity was compared. Solution of the entire tooth tended to reduce this difference considerably. Experiment 5 is the most striking exception to this; in that experiment, however, one of the teeth (the lower left third molar) was unerupted. It was removed surgically from the jaw. With the total solution method, this tooth showed a large uptake in comparison to its counterpart on the right side which was in normal occlusion (relative increase 659 per cent), in spite of the fact that enamel surface activity showed a relative decrease of 25 per cent in this unerupted tooth. With the exclusion of this instance, the average increase in activity using the total solution method (20 per cent) is much less than the average increase observed using enamel surface measurements (163 per cent).

Since P^{32} radiation has very low penetration, the counts obtained from the surface of the enamel may reasonably be considered to be indicative of enamel activity only. In a separate experiment enamel surface activity was found to remain unchanged as the tooth was ground away from the root end until a thickness of 1 mm. of crown remained. From these observations it may be concluded that the enamel surface itself contributes, at least in part, to the differences observed. The activity measured from the enamel surface, however, is considerably less than the total activity obtained from whole tooth digestion. Thus the enamel surface probably contains only a small fraction of the total labeled phosphorus taken up by the tooth.

The difference in the uptake of phosphorus could be due, at least theoretically, either to a change in the tissues of the teeth, thus altering their affinity to phosphorus, or to environmental modifications involving the presentation of greater concentrations of labeled phosphorus to the dental tissues.

This question is difficult to resolve because in the described type of experiment it is not possible to avoid completely the environmental changes which occur around nonfunctioning teeth. For example, the teeth soon become covered with a soft debris which is irritating to the gingival tissues. In time, a gingivitis occurs. Both of these conditions may act to bring greater quantities of P^{32} to the teeth. The debris may become impregnated with P^{32}-laden saliva, thus presenting greater concentrations to the enamel. In this way, even though the debris is removed by cleaning the teeth before counting, these teeth may be more active because they have been previously exposed to greater concentrations of radiophosphorus. Similarly, the gingivitis, because of the accompanying hyperemia, may bring more P^{32} to the teeth.

These factors were minimized by giving the monkeys weekly oral prophylaxis treatment consisting of scaling and pumicing of the teeth. With these procedures the soft tissues did not show noticeable inflammatory changes and the condition of the gingivae in both the chewing and nonchewing halves of the mouth appeared essentially the same.

It has been observed frequently that diets requiring vigorous chewing are associated with low caries incidence.[6] This relationship has also been suggested in

controlled caries studies on institutionalized children.[7]

The most commonly accepted interpretation has been that such diets prevent accumulation of debris about the teeth, thus keeping bacterial action at a minimum.[8] This view is particularly attractive to those who believe that the attacking forces are all-important in the caries process. On the other hand, if the caries process can be influenced by a changing resistance of the tooth to attack, another mechanism should be considered; namely, that vigorous chewing may increase this resistance by affecting the structure, composition or metabolic activity of the tooth.[9] The modifications in the phosphorus exchange described here cannot be linked directly to caries susceptibility; they may be regarded, however, as an indication of a sensitive response of the various dental tissues to use or nonuse of the teeth.

SUMMARY

Unilateral chewing was induced in rhesus monkeys by intracranial section of the motor division of the fifth nerve or by extraction of one quadrant of teeth. Three months to three years after the surgical procedures the monkeys were injected intraperitoneally with radioactive phosphorus. Three to 28 days after the injection of P^{32} the teeth were extracted and the activity of each determined both from the enamel surface and by its total dissolution and measurement of the activity of the resulting solution.

In eight of nine tests involving left-right paired comparisons, the measurement of activity from the enamel surface showed an increase in the uptake of P^{32} in the teeth of the nonchewing side ranging from 31 per cent to 358 per cent. Measurement of activity of the entire tooth in solution indicated that the teeth of the nonchewing side showed an increase in uptake of P^{32} ranging from 8 per cent to 77 per cent in 8 of 11 experiments.

The modification in the P^{32} uptake may be considered as indicating that the various dental tissues are not indifferent to the functional stresses to which they are exposed.

6. Neumann, H. H. Dental caries. Lancet 252:807 June 7, 1947.

7. Neumann, H. H.; Lefkowitz, W., and DiSalvo, N. A. Relation of function to caries rate. J.D. Res. 31:200 April 1952.

8. Klatsky, M. A comparative analysis of masticatory function and its relation to dental disease in ancient and modern man. J.A.D.A. 24:932 June 1937.

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Formula for Human Progress • When every farmer leaves his acres a little better than he found them; when every worker leaves the imprint of human honesty and human dignity on every task performed, however humble; when every lawmaker helps to render human relations a little more equitable; when every judge leaves his court a tradition of a little more justice; when every doctor, every teacher, every investigator work more for love and less for hire; when every statesman leaves the path of compromise, conciliation and approximate justice a little more accessible and secure, we shall have something greater than fat cattle, marble palaces, tall buildings, radios defiling the pure ether with black lies, and mighty airships spewing pain and death on women and children. Even then, we shall not have perpetual health, not even perpetual youth. But we shall be well on the road to earn the designation: wise men. We shall still struggle for life and light, but shall have left behind the follies, the fears, and the fights of the jungle.—*Anton J. Carlson, The Fundamental Sciences—Their Role in Medical Progress, 1939.*

Hygroscopic expansion of dental investments

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Hygroscopic expansion is manifested by the increase in volume of a gypsum product when it is allowed to set under water or in contact with water other than that incorporated in the mixture at the time of setting. The expansion appears to differ chiefly in magnitude from the usual setting expansion which occurs when a gypsum product sets or hardens in air, out of contact with water other than the gauging water.

Hygroscopic expansion was first discovered by Scheu,[1] and was used by him for the compensation of casting shrinkage.[2,3] Hollenback later perfected the technic for producing precision castings by shrinkage compensation with hygroscopic expansion, and the well-known "Hollenback casting technic"[4] resulted.

There are a number of factors which are known to affect the magnitude of the hygroscopic expansion of a casting investment, such as the water:powder ratio and the length of time that the investment is subjected to the water bath after the initial set.[1,2] The lower the water:powder ratio, the greater is the hygroscopic expansion, and the sooner the investment is immersed in water at or after the initial setting time, the greater is the expansion.

Scheu determined the effect of many other variables on the hygroscopic expansion. Many of his conclusions were fundamental and his papers are basic to all research in this field. The following experiments are in part repetition of some of Scheu's work under controlled laboratory tests with more modern equipment and materials.

In brief, the technic advocated by Hollenback[5] is to invest the pattern under vacuum in an investment with a prescribed water:powder ratio. The casting ring containing the invested pattern is immediately immersed in a water bath at a temperature of 37°C. (99°F.) for 30 minutes. The wax pattern is then eliminated by suction, and the mold is heated to 800° to 900°F. (430° to 480°C.), at which temperature the castings are made. The castings so obtained are justly famous for their precision.

Although accurate castings can be obtained with the Hollenback technic, little

Condensed version of a basic thesis originally submitted by Degni in partial fulfillment of the requirements for the degree of Master of Science in Dentistry, Northwestern University Dental School, 1946.

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4. Hollenback, G. M. Precision gold inlays made by a simple technic. J.A.D.A. 30:99 Jan. 1943.

5. Hollenback, G. M. Simple technic for accurate castings: new and original method of vacuum investing. J.A.D.A. 36:391 April-May 1948.

Table 1 • Magnitude of hygroscopic expansion as determined by the trough method

Liner	Hygroscopic expansion (%)
Aluminum foil (1 piece)	0.60
Wax paper (3 pieces)	0.65
Coating of mineral oil on the trough surface	0.66
Aluminum foil (1 piece, oiled)	0.75
Aluminum foil (5 pieces, oiled)	0.77
Aluminum foil (20 pieces, oiled)	0.96
Wet asbestos (1 piece)	1.05

knowledge is at hand as to the magnitude of the mold compensation obtained by means of the hygroscopic expansion. The following experiments were performed in the hope that additional information concerning this point might be obtained thereby.

MAGNITUDE OF HYGROSCOPIC EXPANSION

The first method used in these experiments for the measurement of hygroscopic expansion was with the conventional trough and comparator microscope apparatus, first described by Taylor and his co-workers.[6] The equipment consists of a trough, approximately 40 cm. in length. The investment is spread out along the trough, on wax paper previously placed in position to reduce the friction between the investment and the metal surface of the trough. Comparator microscopes are focused on metal markers placed at either end of the investment specimen to be measured. The average deviation of the results presented in Table 1 is approximately ± 0.04 per cent.

When the hygroscopic expansion was to be measured, water at 37°C. (99°F.) was poured over the specimen immediately after it was prepared; the water was maintained at this temperature throughout the test. A commercial investment was used for these tests. The same water:powder ratio and mixing time was used throughout.

It was found that the friction of the wax paper against the trough was an important factor in the determination of the magnitude of the hygroscopic expansion. The use of lining materials other than wax paper changed the results considerably.

The results of the various tests with the various lining materials are shown in Table 1. When only one piece of the liner was used, it was laid along the entire length of the trough. When more than one piece was used, the pieces were overlapped from the center outward toward the ends of the trough. In general, the overlapping of the pieces reduced the friction and consequently increased the hygroscopic expansion. As can be noted from Table 1, the greatest expansion was obtained when a liner consisting of a single layer of asbestos was used.

The fact that an asbestos liner is universally employed in casting rings in order to provide space for the setting expansion of the investment is evidence that it is effective in preventing friction and confinement. However, inasmuch as the surface area of the asbestos exposed to the investment in the trough is so much greater than in an inlay casting ring, it is conceivable that a greater hygroscopic expansion might occur in the inlay ring than in the trough since the frictional retention in the latter case should be less. Furthermore, the water in the asbestos liner probably acts to accentuate the expansion,[3] and the increased surface for sorption of water produced by the asbestos may well be a factor also in this instance.

In order to test this consideration, a casting ring, 39 mm. in length and 28 mm. in diameter, was lined with one layer of wet asbestos, and filled with in-

6. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T. Dental inlay casting investments: physical properties and a specification. J.A.D.A. 17:2266 Dec. 1930.

vestment. A microscope cover slide was then placed on top of the investment, with its corners resting on the casting ring. The entire assembly was then immersed in a water bath at 37°C. (99°F.), and the spindle of a dial gauge was carefully lowered onto the cover glass.

A hygroscopic expansion of 0.8 per cent was obtained with this method. When the spring of the dial gauge was counterbalanced, however, the hygroscopic expansion was 1.8 per cent.

In order to investigate the inhibiting effect of the dial gauge still further, a sewing needle was waxed perpendicularly to the cover glass. A cathetometer was focused on a scratch on the needle, and the hygroscopic expansion was measured as before. In this instance, its magnitude was found to be 2.1 per cent.

In order to test the inhibiting effect of the asbestos liner, the ring was removed from the freshly mixed investment the instant that no slump could be observed, just before the initial set. The hygroscopic expansion was found to be 2.2 per cent in this instance, when it was measured with the counterbalanced dial gauge as previously described.

It became evident that no absolute value for the hygroscopic expansion could be obtained, since its magnitude was apparently a function of the method of measurement employed and its degree of confinement and frictional retention. Inasmuch as the method in which the counterbalanced dial micrometer was used with the asbestos lined ring appeared to be the most simple and reliable, it was used to determine the relative effect of certain variables in manipulation.

COMPOSITION OF THE INVESTMENT

The principal ingredients in any gypsum investment are finely divided silica and calcium sulfate hemihydrate. The calcium sulfate hemihydrate is usually present in the form of "Hydrocal."

Table 2 • Effect of the Hydrocal content on the hygroscopic expansion of an investment

Hydrocal content (%)	Hygroscopic expansion	
	In air (%)	Under water (%)
5	2.2	3.7
10	2.0	3.5
15	2.0	3.4
20	1.7	3.2
25	1.8	2.2
30	1.7	1.9
100	....	0.6

A number of experimental investments were prepared by the Ransom and Randolph Company specifically for this research. The investments differed in composition only in their calcium sulfate alpha-hemihydrate (Hydrocal) content, which was varied in steps of 5 per cent by weight from 5 to 30 per cent.

The hygroscopic expansion was determined for each of the experimental investments and pure Hydrocal in the manner described. The hygroscopic expansion was determined both while the investment was setting in the asbestos-lined casting ring in air and when it was setting under water, also in an asbestos-lined ring. The results are presented in Table 2; the results are the average of three or more trials.

Two conclusions can be drawn from the data: (1) the less the Hydrocal content of the investment, the greater is the hygroscopic expansion, and (2) the hygroscopic expansion is greater when the investment is allowed to set under water, than when it hardens in an asbestos-lined casting ring in air.

EFFECT OF DRYING

Since the hygroscopic expansion occurs only in the presence of water external to the gypsum material during setting, it is possible that the excess water can be removed by drying in air, with a subsequent contraction of the investment. In

Table 3 • Effect of Hydrocal content on the contraction of the investment after hygroscopic expansion

Hydrocal content (%)	Expansion after drying for 24 hours (%)	Contraction (%)
5	0.3	1.8
10	1.6	0.4
15	1.9	0.1
20	1.7	0.0

order to investigate this effect, the specimens employed for the measurement of the hygroscopic expansion in air were allowed to dry in air for 24 hours, after which period new measurements were obtained.

The results of these experiments are given in Table 3. The contraction (third column, Table 3) was calculated in each instance by subtracting the values for expansion after drying given in Table 3 from the values for expansion in air in Table 2. No contraction of the specimens occurred in air, provided that the investment contained at least 20 per cent Hydrocal. A considerable contraction was observed if the Hydrocal content was less than 15 per cent.

EFFECT OF TEMPERATURE

The hygroscopic expansion of one experimental investment (Hydrocal content, 20 per cent) was determined when the investment was allowed to set in the asbestos-lined casting ring in water at 25°C. (77°F.). The hygroscopic expansion was found to be 2.5 per cent in comparison with 3.2 per cent (Table 2) when the expansion was measured under similar conditions, except that the temperature of the water bath was maintained at 37°C. (99°F.).

DISCUSSION

The fact that the magnitude of the hygroscopic expansion is critically subject to conditions of friction and other confining factors indicates that the investing method employed in the Hollenback technic should be standardized very carefully. An asbestos liner should be employed for the lining of the casting ring, and very likely better results will be obtained if its size and thickness are controlled.

There is no indication in the results obtained as to the exact amount of hygroscopic expansion obtained in the Hollenback technic. The investment was always expanding at the time of the fiducial reading, regardless of the rapidity with which the measuring instruments were adjusted after the investment had been poured into the asbestos-lined casting ring. Measurements made on successive trials indicate, however, that the results are correct within ± 0.05 per cent when one result is compared with another.

In the case of one investment studied, the temperature of the water bath affected the magnitude of the hygroscopic expansion. However, a generalization should not be made in this regard on the basis of one investment composition. Such a finding is in agreement with the work of Landgren and Peyton,[7] but Docking[8] reported that no change in hygroscopic expansion occurred with change in temperature.

The decrease in hygroscopic expansion of the specimens allowed to set in air at 25°C. as contrasted with the expansion of the specimens allowed to set under water at 37°C. (Table 2) probably cannot be attributed entirely to a decrease in temperature. Undoubtedly the amount of water surrounding the investment as the gypsum product begins to crystallize affects the magnitude of the hygroscopic expansion. Such an assumption may ex-

7. Landgren, N., and Peyton, F. A. Hygroscopic expansion of some casting investments. J. D. Res. 29:469 Aug. 1950.

8. Docking, A. R.; Chong, M. P., and Donnison, J. A. Hygroscopic setting expansion of dental casting investments—part 3. Austral. J. Den. 52:320 Sept. 1948.

plain the finding that the specimen of the investment (Hydrocal content, 20 per cent) allowed to set under water at 25°C. exhibited a hygroscopic expansion of 3.2 per cent instead of 1.7 per cent as obtained when a similar specimen was allowed to set in air at 25°C. (Table 2).

According to the data presented in Table 2, the composition of the investment produces a noticeable effect on the hygroscopic expansion. It is evident from the table that the greater the Hydrocal content (or the less the quartz content) the less is the hygroscopic expansion. When the Hydrocal alone was used without quartz, the hygroscopic expansion was only 0.2 per cent greater than the normal setting expansion of the Hydrocal. This effect of the addition of quartz on the hygroscopic expansion has also been demonstrated by Docking.[8] Scheu also showed that the addition of quartz to plaster increased the hygroscopic expansion.[2]

Several theories have been advanced to account for the hygroscopic expansion.[9, 10] According to Ryge, the excess water is absorbed by capillary action into the minute interstices formed during the setting process in the investment. A surface film is thus formed on the particles of inert material (quartz) and gypsum crystals, and as a result of its formation the constituent particles are forced apart and an expansion of the semi-solid mass results.

On this basis, the inert quartz particles presumably act as a wick for the more effective dispersion of the added water. However, if the expansion becomes so great that the crystalline framework provided by the gypsum is too diluted, a shrinkage will subsequently occur (Table 3) as the excess water is removed by evaporation or other means.

Any of the results described herewith can be explained by this theory, as well as those obtained by other investigators.[1-3, 7-9]

If the colloidal theory of the setting of gypsum products is accepted, another theory for the hygroscopic expansion can be advanced. According to the colloidal theory, the first compound formed after the reaction between the water and the hemihydrate is a gypsum gel, and the crystalline gypsum network forms in this gel.[11] In such an instance, it is logical to assume that the external water may cause a swelling of the gel during the semi-solid stage by imbibition. As in the previous theory, the more filler (quartz) present, the weaker the crystalline framework will be, and, consequently, the greater the swelling or expansion. If too much filler is present, the crystalline framework will be so weak that a certain amount of contraction may occur by syneresis as the excess water evaporates.

SUMMARY AND CONCLUSIONS

The effects of various variables on the magnitude of the hygroscopic expansion in a dental investment have been studied. The following conclusions can be given on the basis of the data presented:

1. The hygroscopic expansion is very sensitive to confinement of any type, whether it be pressure or friction. Consequently, it is impossible to establish an absolute magnitude.

2. The greater the amount of Hydrocal in the investment in combination with quartz, the less is the hygroscopic expansion.

3. The hygroscopic expansion is less when the investment is allowed to set in an asbestos lined ring in air at room temperature than when it is immersed in

9. Lyon, H. W.; Dickson, G., and Schoonover, I. C. Mechanism of hygroscopic expansion in dental casting investments. J. D. Res. 34:44 Feb. 1955.
10. Ryge, G., and Fairhurst, C. W. Hygroscopic expansion. (Abst.) J. D. Res. 34:745 Oct. 1955.
11. Skinner, E. W. The science of dental materials, ed. 4. Philadelphia, W. B. Saunders Co., 1954, p. 27.

water at 37°C. in the same asbestos-lined ring.

4. In the case of one investment composition tested, it was found that a lower magnitude of the hygroscopic expansion occurred when a lower temperature of the immersion bath was employed.

5. All the results presented can be explained on the basis of existing theories of hygroscopic expansion.

A method of comparing the wear resistance of various materials used for artificial teeth

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The advent of the plastic tooth in 1940 initiated a new and broad field of materials for use as artificial teeth. Early methods of molding teeth with commercially available materials produced teeth which would be termed inferior in the light of present day knowledge. The major problem with the early plastic teeth was that they tended to wear more rapidly than porcelain or natural teeth. Poor resistance to flame and solvents caused molded teeth to undergo surface degradation and crazing with resulting lowered resistance to wear.

These early faults have been eliminated for all practical purposes in most of the major brands of plastic teeth now available to the profession.

Progress in improving the wear resistance of plastic teeth has been severely handicapped by the lack of an acceptable test method. This paper is being presented in the hope that it will stimulate other research groups to help develop a sound comparative test for wear resistance of teeth.

In the field of plastics there are thousands of possible variations in polymers and copolymers which might be adaptable for use as artificial tooth materials. Polymers are somewhat peculiar in the field of materials testing in that they are remarkably time and temperature sensitive and can be modified by their chemical and physical environment. It is necessary to be extremely cautious in extrapolating test results obtained under one set of conditions to relatively similar conditions (as is frequently done with metals testing). Until good tests are developed to determine the essential physical properties and characteristics of such materials, the dental research worker has no means of screening potentially useful plastics.

ABRASION TESTING

The literature contains a few references to the wear or abrasion testing of teeth. Boddicker[1] attempted to evaluate wear

From the polymer research department, H. D. Justi & Son, Inc.

1. Boddicker, V. S. Abrasion tests for artificial teeth. J.A.D.A. 35:793 Dec. 1, 1947.

resistance by grinding teeth on an articulator and studying the loss of vertical dimension. This method was rejected by the authors because it was deemed impossible to repeat data accurately under the same test conditions. Also, loss in height is proportional to area worn, so that the size and position of contacting surfaces (not measurable) would influence results. The differences in arrangement of teeth and the use of an abrasive substance made the results erratic and introduced a large number of variables into the test.

Slack's[2] method of adapting the Tabor Abraser so that a disk of silicon carbide (carborundum) paper was rotated against the specimen was discarded on the basis that the test measured the abrasiveness of the tooth as well as the resistance to abrasion of the tooth, but not necessarily anything similar to wear in the mouth. For example, loading a piece of plastic with an abrasive produced a tooth with a high rating in this test, even though clinical evidence showed that the wear rate of such teeth was rapid and unacceptable.

Myerson[3] has described an excellent screening test for the wear resistance of plastic teeth, but the test does not involve what would be a normal occlusal wear pattern.

Hamilton[4] has reported on the use of both carborundum and silica filled stones as an abrasive agent. He noted that the order of abrasion resistance was reversed when three brands of plastic teeth were abraded with, first, carborundum and then silica.

In addition to the tests referred to, the authors studied a number of other methods of testing wear resistance.

Cylinders of plastic were rotated against each other and against glass and metal cylinders at various speeds with and without abrasives. It was found that the cylinders polished each other and, therefore, did not produce straight-line data.

Attempts were made to ball-mill teeth and pieces of plastic with steel or porcelain balls, various grades of abrasives, steel balls and abrasives and many other variations. This test was discarded because the rank of specimens could be completely reversed by varying the grit of the abrasive or the shape of the tooth. The test was slow and the wear pattern developed did not at all resemble the type of wear seen on teeth after service in the mouth.

A four year clinical study of occlusal wear was conducted in one of the major dental schools. Extensive observations were made, but the lack of controls and the difficulty of developing any quantitative data made it useless to publish the study. In addition, by the time the data were available, at least two formula changes had been made to improve the plastic teeth, and the data were thus obsolete.

BASIC REQUIREMENTS OF A WEAR TEST

The basic requirements of a good wear test for plastic teeth were listed as follows:

1. The test should relate as closely as possible to clinical conditions and should measure comparative wear of tooth material. (Other industries interested in wear results have come to this same conclusion.)
2. The test should produce results relating closely to clinical observation of various tooth materials where such data are available.
3. The test should produce a wear pattern on the teeth tested similar to that

2. Slack, Fred A., Jr. Preliminary method of testing abrasion hardness. J.A.D.A. 39:47 July 1949.

3. Myerson, Richard L. Method for testing abrasion of plastic teeth. Read before the Twelfth Annual Meeting of the American Academy for Plastic Research in Dentistry. Feb. 3, 1952.

4. Hamilton, Stanley S. Auckland, C. L., New Zealand. Personal communication, Oct. 9, 1950.

seen on teeth present over a long period of time in the human mouth.

4. All artificial teeth tested should be put through a perparatory routine which subjects them to the same conditions encountered in the processing and use of artificial dentures.

5. The test should be conducted either without abrasives or with very mild abrasives, since it is well-known that the human oral mechanism tends to reject gritty particles automatically.

6. The test should be rapid enough to be useful in screening materials, but not so accelerated as to lose its relationship to conditions of use.

7. It should be rapid enough that the development of statistically significant data would be feasible, even though large numbers of materials are being tested.

After several months of investigation, the following test procedure was established to a point where it was felt it was ready for standardization:

Fig. 1 • Teeth mounted, being weighed after drying in vacuum oven

1. Size 30 upper and lower articulating first molars were selected for the test.

2. The teeth were waxed and processed to a small piece of methyl methacrylate denture base material by standard heat-curing technics.

3. The teeth were mounted in aluminum cups with modeling compound, and each assembly weighed after thorough drying in a vacuum oven (Fig. 1). The entire assembly was weighed each time, so that the teeth could be remounted accurately on the wear machine for subsequent wear periods.

4. The upper tooth and cup were mounted on a movable arm of the test machine. The lower tooth and cup were mounted on a fixed member of the machine so that the tooth articulated accurately with the upper tooth when the arm was in a dead-center position (Fig. 2).

5. The stroke of the movable arm carrying the upper tooth was designed to reproduce the impact and sliding force application which would be expected in a working stroke of the mandible. The total weight of the upper arm was one pound. It was found that this was the maximum weight that could be used without causing excessive chipping of porcelain teeth. As porcelain teeth are generally accepted from a wear standpoint, they were used for purposes of comparison. Weights less than one pound would not represent the hardest clinical use and considerably reduced the actual material lost and so increased experimental error. The speed of the stroke was arbitrarily established at 90 strokes per minute, in order to approximate mouth rates of chewing. The fixed lower mounting member was designed to hold a polyethylene cup, of a height that did not interfere with the stroke of the machine, in order that the teeth could be immersed in water or food slurries (Fig. 3). The slurries were replaced every half hour to prevent buildup of breakdown

Fig. 2 • Twelve-headed tester with upper and lower molars mounted in centric position

products, and so forth. The upper arm was so designed that its stroke follows the path of least resistance to reproduce the random path of occlusion seen in the mouth.

6. The machine was then run for approximately four hours (18,500 strokes). This was termed a "wear period." Each stroke of the arm was termed a "wear cycle.'

7. If the test was run under wet conditions, the mountings were then cleaned in water, placed in a vacuum drying oven for 16 hours at room temperature, and weighed. The weight loss was then calculated. (The first wear period was always discarded to allow for variations that might occur before the teeth had "worn in" to occlusion. Difference of weight due to drying variables was determined to be negligible.)

8. The teeth were then worn on the machine for another 18,500 strokes, cleaned, dried and weighed, and the data recorded. This procedure was repeated until four separate sets of data were recorded for each pair. Generally, no systematic change in the amount of wear was noted over many periods of wear. The machine was designed to test 12 pairs of teeth at a time.

EVALUATION OF TESTING DEVICE

Before proceeding to actual comparative testing, an evaluation of the repeatability, accuracy, systematic errors and statistical deviations of the testing device was made.

Since a major problem is the comparison of two kinds of plastic tooth materials (the experimental and a standard tooth) the authors are interested first in a rapid comparative screening test and finally in comparative use data.

It was found that the standard deviation of the ratio of the weight losses of the opposing teeth, that is, the wear of the upper divided by the wear of the lower, was significantly less than the spread of actual weight losses. This is not surprising since the only identical contacts are between opposing teeth; thus one should wear the other at the same rate, given identical materials. A standard deviation of teeth of identical composition of between 1.41 and 0.71 was found to be sufficient to cover experimental

Fig. 3 • Assembly designed to hold water and food slurries

error spread. Difficulty would ensue in measuring much less than this difference in relating the wear of experimental materials. This standard deviation is that of the whole test including the spread of the material and random errors due to test procedures, and must be checked to prevent systematic errors.

Experimental materials are worn against a standard material and null values calculated to indicate whether the wear recorded for the test material is significantly better or worse than the standard. The better materials are then re-evaluated by wearing them under several conditions of use, such as against themselves and against natural teeth. Large numbers of data are used for this phase of testing to eliminate any effect of testing differences.

A maximum of data has been collected on this machine over the past four years. Typical results are shown in Figure 4. It shows the rate of wear on standard crosslinked teeth molded under standard conditions and worn against themselves on the test machine. The standard deviation was arbitrarily widened to assure significant values in improved materials.

Figure 5 shows the distribution of several materials when worn against a standard plastic tooth, dry, wet and under oatmeal slurries. The results with an uncrosslinked plastic tooth, 60A, used extensively from 1946 to 1950, should be noted. Clinical results showed excessive wear in many instances (70A which was not run dry). This shows the effect of excessive crosslinking which results in brittleness. The random spread of results in dry wear with 62A, 68A and 71A should be noted. As teeth are most often in a moist atmosphere these data are not significant. It is felt that the results correlate well with clinical expectation, particularly those obtained with the wet and wet oatmeal slurry which are closest to mouth usage.

The rate of wear of plastic of a standard brand against natural teeth and porcelain teeth is shown in the table. The natural teeth were extracted, unerupted third molars which had been smoothed with a fine cuttlefish disk in the dental engine (unerupted teeth have a much rougher surface than those which have been in service for several years in the human mouth).

Figure 6 shows the relative ranking of

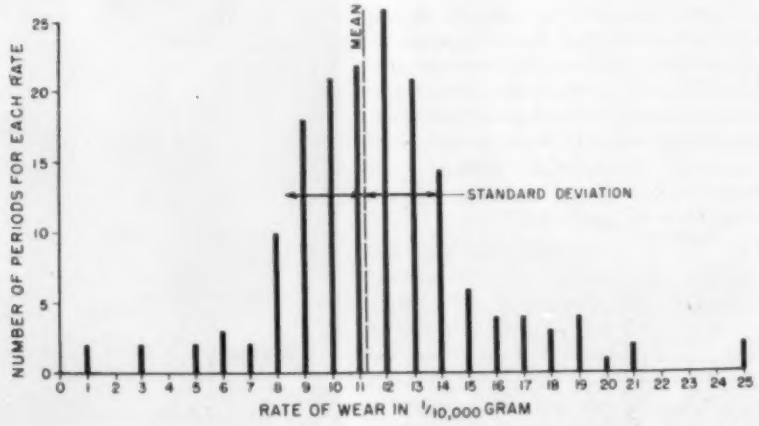
NUMBER OF PERIODS FOR EACH RATE
MEAN
STANDARD DEVIATION
RATE OF WEAR IN 1/10,000 GRAM
0
5
10
15
20
25
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Fig. 4 • Rate of wear versus number of wear periods at each rate in 12-headed tester, dry. Standard teeth against standard teeth

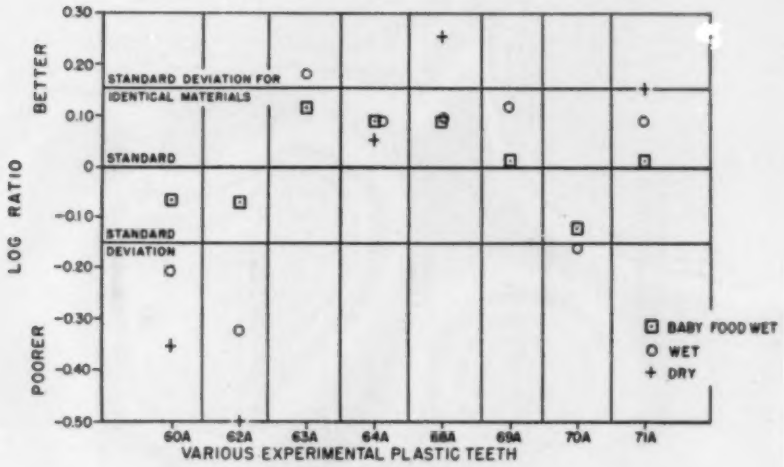

Fig. 5 • Several tooth materials tested dry, wet and with wet baby food against a standard plastic tooth

three different brands of plastic teeth. B and C are crosslinked copolymers presently available to the profession. D is an experimental crosslinked copolymer.

The data presented seem to agree with clinical observations of wear on plastic teeth. Clinical data do not appear in literature and, as previously noted, experience proved such data difficult to obtain. Excessive loss was frequently noted in early manufactured brands. Clinical observation by two of the authors indicates that this loss has been materially reduced with present brands available and the tests so indicate. It is regretted that the dates of purchase of many of these teeth cannot be given as they were purchased at intervals over the past four years, and their identity lost in grouping the data. The primary purpose of the tests is to compare the wear resistance of artificial teeth made of experimental resins, with the wear resistance of resin teeth which were used clinically long enough to establish their wear characteristics.

Table • Standard plastic teeth against porcelain teeth and natura teeth, worn in oatmeal slurry*

Material	Worn against	Average weight loss per 27,000 cycles of wear (in 0.1 mg.)	Average volume loss (0.1 cubic millimeter)
Porcelain	Standard plastic	10	4
Standard plastic	Porcelain	25	25
Porcelain	Porcelain	67	26
Standard plastic	Standard plastic	15–17	15–17
Standard plastic	Natural teeth	14	14

*Unerupted third molars ground with no. 1 cuttle.

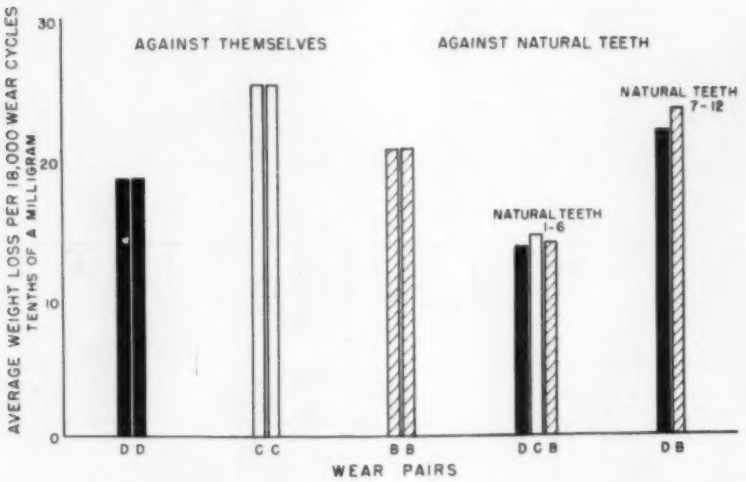

Fig. 6 • Relative rank of three types of plastic teeth

The experimental crosslinked material D presently is undergoing extensive field tests against porcelain teeth and against natural teeth to evaluate the validity of the test results in the light of clinical experience.

After 18 months, clinical observations revealed a wear pattern similar to that seen on teeth tested on the wear machine. Individual cusps showed evidence of some structure loss, but little change in the vertical distance between dentures was evident. This was judged to be a result of the failure to achieve a harmonious occlusal relationship and is similar to the "wearing in" of the first wear period, which is not considered important.

SUMMARY

1. A test for wear resistance of artificial teeth was developed.

2. Data produced on the test appear to correlate with clinical experience.

3. The relative wear resistance of various types of tooth material appears to be measurable. The data developed are thought to be statistically significant.

4. No attempt is made to relate directly the test results with the length of serviceability of artificial teeth in the human mouth because of the difficulties encountered in developing such clinical data.

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Science and Education • We should apply the scientific method to our education at all levels; the scientific integrity, the scientific courage to face all the proven facts, but keep our mouths shut and our pens dry till we know the facts. *Anton J. Carlson, Machinery of the Body.*

Bruxism, a classification: critical review

Samuel C. Nadler, D.D.S., Forest Hills, N. Y.

Mounting interest is being shown in the relationship of psychogenic factors to disease. Dentists are thinking more of the well-being of the total individual and the interrelation of the organs and the tissues of mind or body rather than a small body area or a particular symptom. It has been demonstrated that disturbances in the emotions may cause disturbances in bodily functions and, ultimately, disease of an organ. Thus, the application of psychosomatic medicine is rapidly assuming a more significant role in medicine and the related sciences.

Too, there is more interest in the nature and origin of destructive habits, their diagnoses and their treatment, than ever before. This article will concern itself with one of these destructive habits—bruxism—the habitual grinding of the teeth. Why is bruxism important? It is important because of the potential damage to the teeth, the alveolar bone, and the soft tissues.

In this article an attempt will be made to classify the causal factors of bruxism into groups. This may facilitate a comprehensive picture for practitioners, students and investigators as it appears that there has been little controlled clinical laboratory research on the subject.

HISTORICAL REVIEW

Through the ages, bruxism is indicated in literature. References have been made to the grinding habits as related to emotion. Darwin[1] (1898) quotes Herbert Spencer as stating

> . . . an unquestionable truth that, at any moment, the existing quantity of liberated nerve-force which, in our inscrutable way produces in us the state we call feeling, must expend itself in some direction—*must* generate an equivalent manifestation of force somewhere.

Darwin further reports that, in a man suffering from pain, the "mouth may be closely compressed or, more commonly, the lips are retracted with the teeth clenched or ground together." He observed similar reactions in his study of the emotions in animals.

However, it is only during the present century that any analytical scientific survey of the condition has been attempted.

Marie and Pietkiewicz[2] (1907 and 1908) introduced the term "bruxomania" to designate the habit of gritting the teeth, which was considered to be caused by certain cortical brain lesions and, occasionally, by disturbances in the medulla and pons. This form of grinding habit in chronic cortical lesions was contrasted with that observed in nephritis and in cerebral diseases such as meningitis.

1. Darwin, Charles. Expression of the emotions in man and animals. New York, D. Appleton and Co., 1898.

2. Marie and Pietkiewicz. Bruxomania (gritting of the teeth). Revue de Stomatolgie, March 1907. Reviewed in D. Cosmos 49:525 May 1907.

Bruxomania was observed in cases of paralysis, spasmodic hemiplegia of infancy, dementia epilepsy, chorea and in cerebral spastic infantile paralysis.

Quedenfelt[3] (1908) reporting on 100 cases diagnosed as pyorrhea alveolaris, found that 60 per cent were the result of malocclusion. He declared that certain habits, such as biting thread, holding a pipe, finger nail biting and grinding the teeth at night, were some of the causes producing this malocclusion. Tishler[4] (1928) defined this condition as occlusal habit neuroses. Miller[5] (1938) introduced the term bruxism.

However, Freud's work concerning the underlying emotional patterns and motivations of human behavior and their analyses has made modern concepts of psychosomatics possible.

NOMENCLATURE AND DEFINITION

According to the New Gould Medical Dictionary, the word bruxomania is derived from the Greek word "brychein," meaning to grind or gnash the teeth. Thus, bruxomania is defined as the grinding or pounding of the teeth as a manifestation of neuroses, usually occurring during sleep. Mania is derived from the Greek "mania," defined as madness, and has two meanings: (1) excessive enthusiasm or excitement, a violent desire or passion; (2) a form of mental disorder marked by a sustained elevation of mood with exaggerated feelings of well-being, flight of ideas, delusions of greatness and psychomotor overactivity.

Heretofore, the term bruxism has been limited to the habitual grinding of the teeth during the night, while bruxomania has been used to designate grinding during the day. Certainly, the character of the grinding habit, whether it occurs day or night, is so similar as to be almost identical. It is hardly proper to characterize the day grinding habit with a "manic" label, as some grinding habits are performed innocently and at variance with the meaning of the term mania as defined by the dictionary.

It is recommended that it would be more advisable officially to use the term bruxism regardless of whether it occurs day or night. The term bruxomania should be limited to that same segment of bruxism which can be identified with some distinctive defect in personality, best personified by the gnashing of teeth by those who have a manic situation, as for example, the insane. The term bruxism should be used as an all-inclusive term and a distinction can be made as to whether the grinding be by day or night —it will be so referred to in this article.

For the purpose of expediency bruxism will be defined as the grinding or clenching of the teeth at other times than for the mastication of food. It might facilitate matters if the grinding and clenching habits could be referred to as the bruxistic habit—"bruxistic" thus could be the adjective for the noun, bruxism.

There are two variations of this grinding habit. The first is the clenching habit in which pressures are brough. on the periodontal structures by the repeated clamping of the teeth. The second is the clicking habit, which is usually a rapid, repeated and rhythmic tapping of the teeth. Generally, the grinding and the clicking habits seem less destructive than the clenching because the pressures are more intermittent and are also less sustained.

INCIDENCE

Quedenfelt found some periodontal patients had bruxism as a component. In 1940, Boyens[6] found that condition in 78

3. Quedenfelt, P.B.H. Pyorrhea alveolaris and malocclusion. D. Cosmos 50:473 May 1908.

4. Tishler, B. Occlusal habit neuroses. D. Cosmos 70:690 July 1928.

5. Miller, Samuel C. Textbook of periodontia (and special contributions.) Philadelphia, Blakiston Co., 1938.

6. Boyens, P. J. Value of autosuggestion in the therapy of "bruxism" and other biting habits. J.A.D.A. 27:1773 Nov. 1940.

out of 100 periodontal patients. Leof[7] in 1944, reporting on 171 instances, found 81 per cent of his periodontal patients were so involved. Since such a large percentage of adults suffer from periodontal disease, it follows that a fairly large percentage of the population are suffering from bruxism. In addition, many instances of bruxism are not classified as periodontal, and these would make the total percentage higher.

ETIOLOGY

The causes of bruxism can be ascribed to: (1) local; (2) systemic; (3) psychological; and (4) occupational factors.

Local Causes • Among the local causes, Tishler[4] (1928) reported that mild occlusal trauma or minor anatomic defects, such as the rough end of cusps, will produce discomfort and cause undue tension in neurotics which results in bruxism. Frohman[8] (1931) listed missing teeth, elongated teeth and poorly restored teeth. Miller[9] (1943) stated that in children, traumatic occlusion, dentigerous cysts and faulty eruption of deciduous teeth or permanent teeth may cause grinding. He expressed a belief that adults usually grind their teeth because of faulty occlusion.

Leof[7] (1944) added the presence of calculus, and also lists deep overbite, mutilated occlusion, excessive cuspal inclination and other forms of traumatogenic occlusion, for which a more inclusive term is hyperocclusal stress. Simultaneously, there develops hyperfunction of certain or all remaining teeth. Unilateral occlusion and nonocclusion may also be a factor.

Bruxism may be an unconscious attempt by the patient to establish a greater number of teeth in contact and to counteract local irritating situations or even to overwork an already weakened apparatus. The variety of local factors cited as causes of bruxism indicates that some may not be etiologic, but rather concomitant and incidental.

Systemic Causes • Among the systemic factors are listed gastrointestinal disturbances. In early works, intestinal parasites were often named as causative factors and some investigators mentioned this point of view—Miller[5] (1938), Bunting and Hill[10] (1940). Bunting and Hill[10] stated that bruxism may be caused by irritation elsewhere in the body, as for example, by hyperacid urine, or it may be without any demonstrable cause.

Miller[9] (1943), and Brauer and his coworkers[11] (1947) mention subclinical nutritional deficiencies as predisposing factors to bruxism in children, for example, avitaminosis. There might be a relation between the blood sugar, blood calcium, bone calcium and the intensity of the grinding habits. The role of allergy should also be considered. Perhaps histamine or some histamine-like substance produced during stress periods serves in an underlying causal relation to bruxism.

Miller mentions vesical irritability and includes endocrine disorders such as an overactive thyroid producing nervous tension and, ultimately, bruxism. Is it possible that the effect of hormonal balances between the pituitary gland and the adrenals, and their interrelation with the sympathetic and parasympathetic nervous systems, as observed by Selye,[12] (1952) might, in addition, play a significant role in the etiology of bruxism?

Bunting and Hill[10] stated that bruxism appears as an hereditary factor and may

7. Leof, Milton. Clamping and grinding habits; their relation to periodontal disease. J.A.D.A. 31:184 Feb. 1944.

8. Frohman, B. S. The application of psychotherapy to dental problems. D. Cosmos 73:1117 Nov. 1931.

9. Miller, Samuel C. Textbook of periodontia (oral medicine), ed.2. Philadelphia, Blakiston Co., 1943.

10. Bunting, R. W., and Hill, T. J. Textbook of oral pathology for students and practitioners of dentistry, ed.2. Philadelphia, Lea & Febiger, 1940.

11. Brauer, J. C., and others. Dentistry for children, ed.2. Philadelphia, Blakiston Co., 1947.

12. Selye, Hans. Story of the adaption syndrome. Montreal, Acta. 1952.

occur in several generations of a family. The author has noted this familial relationship.

Perlstein and Barnett[13] (1952) found bruxism more common and more severe in cerebral palsied children than in normal children. Kardiner reported bruxism in a patient with traumatic epilepsy, according to Hart[14] (1948).

Psychological Causes • In recent years the psychological basis of human activities has been investigated. Shaffer[15] (1936) and Wilder[16] (1946) stated that nervous habits are solidifications of useless and diffused motor responses which represent the nonadjustive responses to unsolvable personal problems. By repetition, this directed activity becomes a conscious habit and, by further repetition, an unconscious one. At this level, the activity becomes completely removed from the original cause and without functional purpose.

The emotional tension expressed in such nervous habits as bruxism is built up by the inability to overcome or overlook the problems which include fear, rejection and inability to express rage, hate, or unexpressed libidinous desires (Campbell[17] 1945). Campbell[17] further mentions that dentists have noticed the destructive effects of bruxism. They have realized "that the mechanical stress and strain were but a reflection or consequence of less tangible stress and strain within the personality."

This traumatic situation cannot long remain at a conscious level. It is hidden in the subconscious and kept there by unwavering, though unperceived, mechanisms (Frohman[8] 1931 and Boyens[6] 1940). These repressed conflicts lose none of their strength and translate themselves into the form of dreams and movements such as the grinding and clamping of the teeth during sleep or while concentrating on engrossing activities.

Bartmeier[18] (1945) pointed out that children, who have just reached a point of vocal expression and who are restrained from self-assertion and the release of aggressive feelings, often begin grinding their teeth. Pearson[19] (1948) indicates a basis for this grinding habit as being the fear of tooth loss and the child's use of the mouth to feel and express emotional reactions such as desire, love, hate, cruelty and so forth.

Hart[14] (1948) further points out that in bruxism:

> . . . the primitive gnashing of teeth which our ancestors engaged in when angry has become repressed in the course of civilization and reasserts itself in sleep and dreams when the primitive part of our personalities can partially escape the censor.

Hart, mentioned by Miller[20] (1950), observed bruxism in a high percentage of inmates of mental institutions.

Almansi[21] (1949) states:

> . . . from a psychological standpoint, bruxism is a symptom of emotional illness and, as such, may represent the expression of one of several unconscious drives, particularly of anger, anxiety, hate, aggression, or sadism, which the patient has strongly repressed from his consciousness. As such, it is an important indication of severe frustration and dissatisfaction.

Miller[5] (1938) observed that the grinding habit stemmed from nervousness and overactivity of the brain due to men-

13. Perlstein, M. A., and Barnett, H. E. Nature and recognition of cerebral palsy in infancy. J.A.M.A. 148:1389 April 1952.

14. Hart, H. H. Practical psychiatric problems in dentistry. J.D.Med. 3:83 Oct. 1948.

15. Shaffer, Laurance F. Psychology of adjustment; an objective approach to mental hygiene. Cambridge Houghton Mifflin Co., 1936.

16. Wilder, J. Tic convulsive as a psychosomatic problem. Nervous Child. 5:365 Oct. 1946.

17. Campbell, D. G. Psychosomatic mechanisms in oral diseases. Am. J. Orthodont. & Oral Surg. 31:440 July 1945.

18. Bartmeier, L. H. Psychiatric study of a man suffering from a convulsive disorder. Bull. of Menninger Clin. 7:62 March 1943.

19. Pearson, G. H. J. Psychology of finger-sucking, tongue-sucking and other oral "habits". Am. J. Orthodont. 34:589 July 1948.

20. Miller, Samuel C. Textbook of periodontia (oral medicine), ed.3. Philadelphia, Blakiston Co., 1950.

21. Almansi, R. J. Psychosomatics in dentistry. J. D. Med. 4:98 Oct. 1949.

tal stress. In 1947 Miller[22] stated that bruxism was due to an unrealized aggression and mentions nail biting. Several instances of nail biting associated with bruxism have been observed by the author. Landa[23] (1953) calls bruxism a symptom of psychoneurosis.

There has never been an investigation of the psyche as related to the production of acts of bruxism. In none of the authorities quoted is there any reference made to a question which now becomes apparent; namely, the influence of the psyche on certain bruxistic acts. These seemingly innocent acts are manifestations of psychic phenomena which cause bruxism.

Occupational Causes • Observations have revealed bruxism in persons in a variety of occupations. It is more prevalent than many realize since the unconscious quality of the act tends to keep it unnoticed. So many of the underlying causes of bruxism seem to be psychological in nature and this would tend to keep the knowledge of the act in the subconscious.

Causes of occupational bruxism can be separated for purposes of general classification into three groups. First would be physical; athletes engaged in strenuous activities and concerned with producing maximum physical performances. These include tennis, baseball and football players, runners and others who reach out for the peaks of their endurance. Boxers, who not only use the velum rubber appliance to protect their teeth, but also clench their teeth into it to channel the stress of combat, perform an act of bruxism. It is believed they also use it to prepare themselves psychologically to receive a punch.

Second, under a heading of emotional response, would be classified those engaged in meticulous and precise work. These are such as watch-makers, diemakers, machinists and diamond cleavers, all of whose physical exertion is comparatively slight as compared with their nervous exertion.

In a third general category are those undergoing some form of mental stress. It is easy to say that a specific reaction to mental stress is causing the act of bruxism but far more difficult to say what mental stress is the cause. The question is—is it a "relief" or simply a reaction to some motivating force? Since one action is not performed, another (bruxism) is. The difficulty, of course, lies in the fact that the complexities of personality are being dealt with.

The questioning of subjects will frequently lead to these conclusions: the grinding act (bruxism) is affording relief from the stresses of modern living, or from the complexities of problems facing the individual. The environmental situation might best be exemplified by a victim of the bruxism habit who performs the act as a relief from mental tensions such as the making of deadlines or the meeting of schedules. Toll is taken on the nervous system, tempers become volatile, and patients are reporting an increasing amount of grinding and clenching (bruxism) as an outlet from frustrations.

Bruxism may also be classified according to voluntary and involuntary forms. There is as much difficulty in separating the two as there is between the tension and relief from tension. It must be noted that repeated voluntary acts become involuntary.

Involuntary Forms • It has been reported by a motorist that he receives relief from tension by clenching his teeth when he suddenly applies the brakes to his automobile.

Grinker and Spiegel[24] (1945) in their

22. Miller, S. C., and Firestone, J. M. Psychosomatic factors in the etiology of periodontal disease. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 33:675 Sept. 1947.

23. Landa, J. S. Dynamics of psychosomatic dentistry. Brooklyn, Dental Items of Interest Pub. Co., 1953.

24. Grinker, Roy, and Spiegel, John. Men under stress. Philadelphia, Blakiston Co., 1945.

study of Air Force personnel mention that there are many instances of soldier neuroses because of severe stress. Miller[20] (1950) states that more patients with bruxism appeared for periodontal assistance during wartime. Men engaged in active combat utilize these grinding habits to obtain relief from the tension created by dangerous situations.

In people who are studying and concentrating—if they are grinding their teeth—the observer might notice a slight bulging and rhythmic movement of the temporal and masseter muscles or a very slight continuous and rhythmic movement of the mandible (Bodecker[25]). It has also been observed in people watching television.

Clenching of the teeth has been noticed during the electroconvulsive treatments of psychotherapy and during the recovery from a general anesthetic.

Though not strictly occupational, it has been found that in people who stretch and yawn a great deal, many clench their teeth tightly shut at the completion of the yawn. The grinding habits have also been observed in denture wearers. Some housewives in preparing to open a jar, may clench their teeth. Some perform similarly when slicing bread or tieing and wrapping packages—these may be considered a reflex because of contemplated exertion.

Voluntary Forms • The grinding of teeth in rhythm by dancers and musicians who move their bodies and keep time with music, drummers, for example, may be considered partly voluntary and partly involuntary. Thus the bruxism becomes a part of the general body movement and rhythm. Clenching caused by the tension of waiting for a cue or down-beat by pianists has also been noticed.

The chewing of gum is a habit which also falls into a voluntary and involuntary classification. The chewing of gum may be considered by some a form of rumination; however, it can be looked upon as a form of bruxism. Initially performed as a voluntary act, it later becomes an involuntary masticatory habit. The habitual users of chewing gum are performing the grinding habit. It differs from the grinding habit in that a piece of gum is moving between the occlusal surfaces of the teeth and is voluntary only to the extent of insertion and removal of the chewing gum from the mouth. It appears to be a form of motor activity, unconscious and rhythmic, as is the bruxism habit. The chewing gum habit thus affords a release from tension.

Some men chew cigars; others chew tobacco. Some pipe-smokers clench the stem of their pipe. Other persons have been observed to bite and chew pencils; still others chew on toothpicks, bobby pins, small wads of paper, bite on blankets and linens, all of which might be considered forms of bruxism. Reaction to sudden pain may often produce clenching.

Aerialists who twirl their bodies at high altitudes by gripping an apparatus with their teeth, and stunt men who pull automobiles and lift heavy objects demonstrate an application of sustained biting pressure which can be likened to clenching. Although these are fine applications of biting pressure they could possibly be classified as pure forms of bruxism, with a commercial application.

It might be asked at this time—What is bruxism? What is not? Gottlieb's[26] observation that teeth function less than one hour per day—that, except for normal mastication, the teeth should be held apart for 23 of every 24 hours, the one hour when the teeth are grinding being the sum total of the time spent on masticating food, might serve as a guide. But that is all it should be used for, since clinical research has not confirmed that

25. Bodecker, C. F. Occlusal neurosis, its cause and treatment. J.D.Soc. New York 8:6 Dec. 1941.

26. Gottlieb, B. Traumatic occlusion and the rest position of the mandible. J. Periodont. 18:7 Jan. 1947.

definition as being scientifically accurate. It is worth while noting that in addition to masticating and swallowing, the teeth come together in light contact during speech. Furthermore, the act of swallowing must be more closely observed clinically to determine if it doesn't become a conjunctive process in the bruxistic act. Then only may it be stated that all other forms of the contact of teeth may be considered bruxism.

Thus, a definition of bruxism could be enlarged to be essentially the grinding or the clenching of the teeth at other times than the normal use of them. The question then arises, what is the norm to be used, and an extension of Gottlieb's[26] observation can be used in answer. What is of concern is that the grinding and clenching habits are perversions of the primary purpose of the dentition.

ETIOLOGY IN CHILDREN

As in the adult, the causes of bruxism in children can be equally ascribed to: (1) local; (2) systemic; (3) psychological. In connection with these classifications, additional causes such as developmental and occupational, can be presented.

Developmental Causes • Chadwick[27] (1928) found that, although the first muscle movements in the child occurred to satisfy some wish, very early it showed signs of pleasure through muscular movement. It has been stated that at the time of teething there may be grinding on the gum pads even though no teeth are present.

McBride[28] (1952) mentions that abrasion is seen with frequency on the anterior deciduous teeth and considers bruxism an unconscious attempt to place the individual planes of the teeth so that the musculature will obtain rest. These deciduous teeth do not exfoliate normally because resorption is resisted. He claims that bruxism in children occurs between the sixth and eighth year when the child is exchanging the incisor teeth and, by the time the permanent successors come into position, the habit has been eliminated.

Local, Systemic Causes • Miller[5] (1938) mentioned that night grinding in children may be due to vesical irritability, hyperacidity of the urine, or rectal parasites; and, in 1943, included stomach disorders, nervousness, psychogenic disturbances, traumatic occlusion, faulty dentition and dentigerous cysts. Subclinical nutritional deficiencies have also been considered.

Occupational Psychological Causes • The biting of toys and other objects is common in young children. Some growing children perform the grinding and clenching habit in studying and during school examinations.

Brauer and his co-workers[11] (1947) indicated that bruxism should be regarded as a symptom of nervous tension in the child and the causes sought. Children who are rejected by playmates or parents may develop facial tics and bruxism. Children reacting to pain may grind and clench their teeth.

Almansi[21] (1949) points out, with the advent of teeth,

> . . . the child is now bent not only on deriving satisfaction through the mouth by sucking but aggressive tendencies come to the fore which lead to biting: this is the second phase.

He mentions that the mouth plays an important part through life in the discharge of aggressive and sadistic tendencies, in addition to being an organ of love and hate. Thus, the tendencies may be deviated or sublimated later in life, giving rise to habits such as gourmandizing, biting of objects and the grinding of teeth.

It might be assumed that much of the

27. Chadwick, Mary. Difficulties in child development. London, George Allen & Unwin, 1928.

28. McBride, Walter C. Juvenile dentistry, ed.5. Philadelphia, Lea & Febiger, 1952.

bruxism in children is on a psychogenic basis. Therefore, it would be of serious interest to determine what kind of child develops bruxism. Are certain types of personalities predisposed to this condition? Has the child emotional problems in excess of what is typical for his age? If so, could these problems be in any way related to his bruxism? Is there a strong repressed oral aggression? Is this aggression directed primarily against himself or others? Is this problem of oral aggression more prominent in younger or older children?

SUMMARY

1. Bruxism may affect so large a percentage of the population as to approach universality. This condition appears at practically all ages in man, and may be as old as man himself. It may occur in several generations of a family—how much is due to heredity and how much to mimicry is a question to be considered.

2. Research is indicated as to the etiology of bruxism, whether it be on a local, systemic, psychological or occupational basis. Many causes have been advanced but not all have been substantiated. Distinction should be made as to whether or not concomitant, incidental, predisposing factors or true causes are being dealt with.

3. It is respectfully recommended to the Bureau of Library and Indexing Service of the American Dental Association that the term bruxism be officially designated as an all-inclusive term for the abnormal grinding and clenching habits regardless of when they occur. Bruxomania should be considered as a specialized form of bruxism.

4. The dental profession should become more observant of the characteristic manifestation and incidence of bruxism, especially in patients with periodontal disease, as the unconscious quality of the act keeps it often undetected.

5. The major causes of bruxism seem to be on a psychological basis and concerned with the personality of the individual.

6. Acts which have heretofore been considered innocent ones, may now be construed as vicious concomitants of the habit of bruxism, such acts as the chewing of gum and the biting and clenching of foreign objects. These will bear closer scrutiny as decisive factors in the increasing incidence of bruxism.

7. It would appear that the act of bruxism affords the individual an opportunity to take out on his own body the frustrations and tensions which beset his personality.

8. The role of physical and mental stress as causation to bruxism in daily living is highly significant. The occupational background of patients afflicted with abnormal bruxistic habits should be examined in order to determine how the relief from tension or the release of tension may be channeled into less destructive paths.

9. Extensive research studies in children who have bruxism are recommended with these questions to be considered: (1) What kind of child develops the act? (2) Is there a factual basis for the relationship between the sucking habits and the bruxism habits of the child? (3) Is there a common denominator in children who develop bruxism? If suitable answers can be found to these questions, and if adequate early assistance is given the child, can the condition be prevented and further damage minimized?

10. Research, combined with psychological and clinical laboratory studies, is also indicated into the instances involving the jaws and teeth in seemingly innocent acts which tend to degenerate into the habit of bruxism, so that the part apparently played by the compulsion of the psyche can be fully evaluated by both the medical and dental professions.

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Effect of certain restorative materials on solubility of enamel

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One of the primary requisites for the ideal restorative material would be an actual union with the surrounding tooth structure in order to prevent ingress of saliva, fluids and debris. There is ample evidence[1-5] to indicate that none of the presently used materials seal the marginal areas, and it can thus be assumed that fluid exchange is taking place continually. Many factors, such as temperature change in the mouth,[2-6] galvanic action between dissimilar metals,[7,8] and the solubility of certain materials in dilute organic acids[9-11] make the problem a difficult one. Such seepage must be one of the main factors contributing to recurrent caries.

This lack of a permanent seal between the material and the cavity walls has placed increasing emphasis on the germicidal or bacteriostatic properties of the restorative material. Any ideal material should have the ability to inhibit bacteria growth or to reduce acid production of the oral bacteria. The need for a therapeutic effect by the filling material is particularly acute in view of the marginal leakage which is now known to exist with all materials and the constant danger of bacterial invasion. It may be equally important in such procedures as the cementation of orthodontic bands where solubility of the cement poses a real problem.

Although many studies have been concerned with the bacteriostatic or germicidal properties of all dental materials, the exact influence of each is not at all well defined. Differences in the type of bacteria employed, in bacteriological technics and in the number and frequency of platings have contributed to the lack

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5. Zander, H. A. Effects of dental materials on the periodontal tissues. Paper read at the 34th annual meeting of the International Association for Dental Research, March 22-26, St. Louis, 1956.

6. Seltzer, S. The penetration of microorganisms between the tooth and direct resin fillings. J.A.D.A. 51:560 Nov. 1955.

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8. Phillips, L. J.; Phillips, R. W., and Schnell, R. J. Measurement of the electric conductivity of dental cement. IV. Extracted human teeth; in vivo tests; summary. J. D. Res. 34:839 Dec. 1955.

9. Paffenbarger, G. C.; Schoonover, I. C., and Souder, W. Dental silicate cements: physical and chemical properties and a specification. J.A.D.A. & D. Cosmos 25:32 Jan. 1938.

10. Henschel, C. J. Observations concerning in vivo disintegration of silicate restorations. (Abst.) J. D. Res. 28:528 Oct. 1949.

11. Skinner, E. W. The science of dental materials, ed. 4. Philadelphia, W. B. Saunders Co., 1954.

of conclusive data. Some investigations have shown definite antibacterial effects with gold,[12,13] copper amalgam,[13,14] copper, silver and mercury,[15] dental cements,[13,16,17] and zinc oxide-eugenol.[18] Other studies have cast doubt on many of these findings,[19,20] however, and the exact effect of any given material in minimizing or preventing bacterial growth or acid production must still be considered controversial.

It is commonly recognized, however, that the incidence of recurrent caries around the silicate restoration is noticeably less than that for other types of filling materials.[10,21,22] Although silicate cement has many inherent weaknesses, it must be acknowledged that it is superior from this standpoint. The mechanism for this protective action remains obscure, but generally it has been attributed to the fluoride present in the cement. A fluoride flux, usually calcium fluoride or cryolite (Na_3 Al F_6), is used by the manufacturer in fusing the powder, which results in fluorine concentrations of over 10 per cent in commercial products.[11] The silicate restoration is, of course, quite soluble in oral fluids, particularly the weak organic acids that may be present in a protected region.[23-25] Although no data are available concerning the amount of available fluoride which is leached out of the clinical restoration, Crowell[26] found 0.007 per cent fluoride present in 50 ml. of solution after immersion of silicate powder in distilled water for two months.

Thus it has been felt that the fluoride which is being continually dissolved or eroded off the surface of the restoration acts either as a germicidal agent or possesses antienzymatic properties which inhibit acid formation of microorganisms. Recent work, however, seems to indicate that concentrations of fluorine which would be present under these conditions might have limited, if any, beneficial effect.[27,28] At any rate, any lasting inhibitory action of the fluoride ion in the silicate restoration on microorganisms remains to be proved, even though this ion is commonly credited with the lowered incidence of recurrent caries around that particular restoration. On the basis of this theory it has been suggested that low concentrations might be added to inert materials, such as resins, to provide some therapeutic protection.[22]

One other explanation has been offered for this unique anticariogenic property of the silicate restoration, and in view of the lack of evidence to support the germicidal or antienzymatic theory, it must be given serious consideration. Volker[21] showed some reduction in the acid-producing ability of microorganisms when silicates were added to a solution containing saliva, glucose and powdered enamel. A more interesting observation, however, was a reduction in enamel solubility, in acetic acid, if the enamel was

12. Miller, W. D. Microorganisms of the human teeth. Philadelphia, S. S. White Dental Mfg. Co., 1890.

13. McCue, R. W.; McDougal, F. G., and Shay, D. E. The antibacterial properties of some dental restorative materials. Oral Surg., Oral Med. & Oral Path. 4:1180 Sept. 1951.

14. Pickerill, H. P. The antiseptic value of filling and dressings. Brit. D. J. 30:1185, 1909.

15. Staub, H. A contribution to the question of the destructive action of metals on bacteria. Brit. D. J. 42:958 Oct. 15, 1921.

16. Hill, T. J., and Boester, K. W. Relative efficiency of germicidal cements. J.A.D.A. 21:1565 Sept. 1934.

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18. Turkheim, H. J. In vitro experiments on the bactericidal effect of zinc oxide-eugenol cement on bacteria containing dentin. J. D. Res. 34:295 April 1955.

19. Shay, D. E.; Allen, T. J., and Mantz, R. F. The antibacterial effects of some dental restorative materials. J. D. Res. 35:25 Feb. 1956.

20. Sheppard, M. S. The bactericidal action of pure metals and metal fillings. D. Cosmos 77:968 Oct. 1935.

21. Volker, J.; Bekaris, B., and Melillo, S. Some observations on the relationship between plastic filling materials and dental caries. Tufts D. Outlook 18:4, 1944.

22. Paffenbarger, G. C.; Nelsen, R. J., and Sweeney, W. T. Direct and indirect filling resins: a review of some physical and chemical properties. J.A.D.A. 47:516 Nov. 1953.

23. Rosthj, J. P. Tests on silicate cements. Dansk. Tandlaegbl. 33, 1929.

24. Phillips, R. W., and Swartz, M. L. Unpublished data.

25. Voelker, C. C. Dental silicate cements in theory and practice. D. Cosmos 58:1098 Oct. 1916.

26. Crowell, W. S. Physical chemistry of dental cements. J.A.D.A. 14:1030 June 1927.

27. Lilienthal, B. Investigation of the anti-enzymatic action of fluoride at the enamel surface. J. D. Res. 35:189 April 1956.

28. Lilienthal, B. The effect of fluoride on acid formation by salivary sediment. J. D. Res. 35:197 April 1956.

first washed with an extract of silicate cement. This reduction was attributed to a reaction of the fluorine present in the silicate filtrate with the enamel. These meager data of Volker's represent the only published research indicating that this possible mode of action in the silicate restoration could account for the lower incidence of recurrent caries.

The influence of various fluoride compounds in reducing enamel solubility has, of course, been well established.[29-32] Although the exact mechanism is unknown, unquestionably the inorganic portion of the enamel is chemically altered to produce a substance more resistant to acid attack.[32-35] Abundant research has indicated that this lowered solubility of the tooth structure, as induced by the topical application of a solution of sodium fluoride or fluoridation of the drinking water, probably accounts for the reduction in dental caries.[36-38] Thus the data obtained by Volker would seem to indicate a surface reaction of the fluoride in the silicate with the enamel. Such a reaction could occur either during the set of the cement while the free acid permitted ionization of the fluoride, or subsequently, as the fluids penetrating the margins produced dissolution and liberation of fluorine. If this phenomenon were to be definitely confirmed by more profound studies, then the lowered incidence of recurrent caries around the silicate restoration might be understood more readily.

Information concerning this mechanism would be of even greater value in the general problem of developing better restorative materials. It has been pointed out that there is a definite need for germicidal or bacteriostatic properties with any filling material, and doubt exists that any of the popular materials possess such characteristics. This is particularly true with the resin restorative materials or resin cements which are extremely inert. Attempts to add germicidal agents to such materials have been unsuccessful because of the high solubility of the added agent, which results in rapid loss of potency.[39]

Naturally any antibacterial agent, if it is to be effective, must be soluble and continually liberated at the surface of the restoration. Thus, the addition of an adequate amount of the antibacterial compound increases the solubility of the entire material, which is never desirable. If, however, fluoride compounds might be added in low concentrations, which would not increase the solubility of the material appreciably, and if the mode of action of the compounds would not be dependent on antibacterial effects but rather would react with the enamel to produce a more acid-resistant adjacent tooth structure, then a truly superior restorative material might be developed.

STATEMENT OF PROBLEM

The purpose of this investigation was: (1) to determine whether silicate cement and certain other common restorative materials influence the solubility of enamel, and (2) if such a mechanism was

29. Volker, J. F. Effect of fluorine on solubility of enamel and dentin. Proc. Soc. Exper. Biol. & Med. 42:725 Dec. 1939.

30. Muhler, J. C., and Van Huysen, G. Solubility of enamel protected by sodium fluoride and other compounds. J. D. Res. 26:119 April 1947.

31. Manly, R. S., and Bibby, B. G. Substances capable of decreasing the acid solubility of tooth enamel. J. D. Res. 28:160 April 1949.

32. McCann, H. G., and Bullock, F. A. Reactions of fluoride ion with powdered enamel and dentin. J. D. Res. 34:59 Feb. 1955.

33. Fischer, R. B.; Muhler, J. C., and Wust, C. J. Effects of several fluoride reagents on the surface structure of powdered dental enamel. J. D. Res. 33:50 Feb. 1954.

34. Newman, W. F., and others. The surface chemistry of bone. 2. Fluoride deposition. J. Biol. Chem. 187:655 Dec. 1950.

35. Brudevold, F., and others. Uptake of tin and fluoride by intact enamel. J.A.D.A. 53:159 Aug. 1956.

36. Martin, N. D. The scientific evaluation of fluoride as a means of preventing dental caries. Austral. D. J. 1:141 June 1956.

37. Shaw, J. H. Fluoridation as a public health measure. Washington, D. C., American Association for the Advancement of Science, 1954.

38. American Dental Association. Fluoridation in the prevention of dental caries, a manual, ed. 4. Chicago, American Dental Association, 1954.

39. Harris, N. O., and Fischer, T. E. A study of the antibacterial properties of plastic filling materials. Paper read at 33rd annual meeting of the International Association for Dental Research, Chicago, March 1955.

evidenced, to determine whether fluoride compounds might be added to materials which have no antibacterial properties in order to reduce enamel solubility and thereby protect better the critical marginal regions against recurrent caries.

PROCEDURE

The following products, purchased on the open market, were used in this study:

Brand	*Manufacturer*	*Date purchased*
A. Silicate Cement		
deTrey's	L. D. Caulk Co.	7- 1-55 to 7-25-56
S. S. White Filling Porcelain	S. S. White Mfg. Co.	7- 1-55 to 7-25-56
Berylite	Ames Co.	8- 3-55 to 9- 1-56
B. Zinc phosphate cement		
Tenacin	L. D. Caulk Co.	7- 1-55 to 7- 6-56
S. S. White Zinc Cement	S. S. White Mfg. Co.	7- 1-55 to 7- 6-56
C. Resin		
Kadon	L. D. Caulk Co.	4-16-56 to 8- 3-56
FluorOn	Am. Consol. Mfg. Co.	4- 3-56 to 9- 2-56

Since a great number of individual tests were to be made, the number of materials tested had to be limited. It was felt, however, that this group was adequate and representative, and that the results obtained would be characteristic for each class of material. One of the silicates, Berylite, was selected since, according to the manufacturer, it contains no fluoride but is made with a beryllium flux. To the authors' knowledge this is the only silicate presently available which contains no fluoride, and thus it serves as a suitable control for the more common fluoride-containing silicates. FluorOn was selected since, according to the manufacturer, it is a resin containing both sodium and stannous fluoride.

All were handled according to the manufacturers' directions with regard to powder-liquid ratios, mixing procedure, and so on. Certain experimental products were compounded by the L. D. Caulk Co., but will be discussed later in the paper.

There are advantages and disadvantages in using either the intact enamel surface or powdered enamel. More variation obviously exists in the individual specimens when the intact surface is employed than when pooled samples of powdered enamel are used; however, the intact whole surface more closely approximates the clinical conditions to which the tooth is subjected. It was felt that series of tests should be made using both intact and powdered enamel in order to corroborate the results.

Intact Enamel • The experimental procedure involved the use of a window-type test as previously employed in solubility studies by Brudevold,[40] Swartz and Phillips,[41,42] and Boyd.[43] This method makes it possible to use the normal outer layer of enamel and to expose the same region repeatedly, if desired, to the decalcifying solution.

40. Brudevold, F. A study of phosphate solubility of the human enamel surface. J. D. Res. 27:320 June 1948.

41. Swartz, M. L., and Phillips, R. W. Solubility of enamel on areas of known hardness. J. D. Res. 31:293 April 1952.

42. Crouse, J.; Swartz, M. L., and Phillips, R. W. Enamel solubility of polished and roughened surfaces. Ann. Den. 13:37 June 1954.

43. Boyd, T. M. Window technic for enamel solubility studies. (Abst.) J. D. Res. 29:675 Oct. 1950.

Sound central incisor teeth were used. They were selected carefully in order to minimize such irregularities as cracks, pits and decalcified regions. The teeth were stored in tap water immediately after extraction and throughout the test periods. To reduce further any surface imperfection, all teeth were lightly buffed on a felt wheel with levigated alumina.

The method for preparing the windows has been described.[42] Briefly, it involves the use of lead foil and electrical tape, with a prepunched 3.5 mm. window. The remainder of the tooth was sealed from the decalcifying solution by the tape and wax. All specimens were inspected microscopically after decalcification to make certain no leakage occurred. In order to re-expose the identical area, the tooth was marked in such a manner that the tape could be replaced in exactly the same position.

The procedure used in studying the effect of the various materials was as follows. The tooth surface was polished and the window placed. The tooth, with the enamel window exposed, was suspended in 10 ml. of pH 4.0 acetic acid solution, mechanically agitated, for 30 minutes. This solution was diluted to 25 ml. and subsequently analyzed for calcium and phosphorus to determine the original solubility of this region. The tape and wax were removed and the tooth surface buffed until all of the etched surface was removed. The restorative material was now mixed and placed immediately on the dried labial surface. The tooth and material were placed for 15 minutes in a humidifier at approximately 100 per cent humidity. At the end of this time, the tooth was transferred to a test tube containing 15 ml. of distilled water and was stored for the designated time. The water was changed at the end of each 24 hours.

At the end of the storage period, the restorative material was removed from the enamel surface, the tooth lightly buffed, and the window placed in exactly the same position. This region then was decalcified as before and calcium determined. Thus it was possible to measure the solubility of the same region before and after exposure to the particular dental material.

Calcium was determined by the method of Solomon, Cabrio and Smith,[44] whereas phosphorus was measured by the colorimetric method of Fiske and Subbarrow.[45] All analyses were run in triplicate, and blanks and known samples run with each group. Glass-distilled water was used throughout for the preparation of reagents, dilutions, washings and for rinsing of glassware.

When using intact enamel surfaces, it must be recognized that considerable variation exists in the solubility of adjacent regions or at various depths of a given tooth surface.[40-42, 46] Likewise, the behavior of the intact surface when exposed to a fluoride medium will vary from tooth to tooth. Thus it is necessary to run an adequate number of specimens before arriving at a valid conclusion. In this investigation, a minimum of eight teeth was used for any given series of tests.

Powdered Enamel • A pooled powdered enamel sample was prepared by crushing dried extracted teeth in a diamond mortar and pestle. The particular particle size used in this study was that which would pass a 100 mesh screen but would be retained by a 140 mesh screen. The method of separating the enamel portion from the other constituents was actually a combination of those of Manly and Hodge[47] and Battistone and Burnett.[48]

44. Solomon, K.; Gabrio, B. W., and Smith, G. F. A precision method for quantitative determination of calcium in blood plasma. Arch. Biochem. 11:433 Nov. 1946.

45. Fiske, C. H., and Subbarrow, Y. A colorimetric determination of phosphorus. J. Biol. Chem. 66:375 Dec. 1925.

46. Kanthak, F. F. Velocity of solubility of various samples of dental enamel. J. D. Res. 14:21 Feb. 1934.

47. Manly, R. S., and Hodge, H. C. Density and refractive index studies of dental hard tissues. J. D. Res. 18:133 April 1939.

Separatory funnels, as suggested by the latter, were employed rather than centrifugation.

The original solubility figures or control values for this pooled sample of enamel were established by treating 100 mg. samples of enamel with an acetic acid solution, pH 2.5, for 20 minutes.

The exact procedure was to add 25 ml. of the decalcifying solution to a test tube containing the enamel sample and agitate for 18½ minutes. The mixture was then centrifuged for one minute. Exactly 20 minutes from the time the acid was added, a 1 ml. aliquot was taken and diluted to 50 ml. The quantities of calcium and phosphorus present in this solution were measured.

The calcium and phosphorus solubilities of 20 enamel samples, taken from the pool, were determined in this manner. The average quantity of calcium dissolved during the decalcification period was 1.544 mg. per 100 mg. sample. The standard deviation was calculated and found to be ± 0.06 mg. per 100 mg. sample. The mean phosphorus value was 0.748 mg. per 100 mg. sample with a standard deviation of ± 0.017 mg. per 100 mg. sample. The enamel used in all of the succeeding tests was taken from this pool; thus, these figures were used as the control calcium and phosphorus values throughout the following experiments.

Two series of experiments, utilizing two different procedures, were run in studying the effects of the different materials on powdered enamel. It was felt that each method offered certain technical advantages over the other, and by employing both procedures a better evaluation could be made.

As mentioned previously, Volker[38] stored silicate cement in water and then washed the powdered enamel with the extract, noting the resultant effects on the solubility of the enamel. The first series of tests were made by employing this basic procedure. The exact method used was to mix 1.3 Gm. of cement powder with the appropriate quantity of liquid. Mixing was carried out according to the accepted procedure for each material. One hour from the start of the mix, the hardened cement was powdered and 1 Gm. of the powdered material placed in a flask containing 50 ml. of distilled water. This mixture, agitated intermittently, was allowed to stand for 48 hours. It was then filtered and 15 ml. of the filtrate added to a test tube containing 130 mg. of powdered enamel. The enamel samples were stored, with the filtrates, for periods of 24 hours and 72 hours. At the end of the designated periods, the extract was removed by filtration, the enamel washed, nine times, with distilled water and dried. One hundred milligrams of this enamel, thus treated, were then subjected to decalcification, following the procedure used for the controls. A 1 ml. aliquot of this solution was diluted to 50 ml. for the subsequent analysis for calcium and phosphorus.

It was felt that a method somewhat more comparable to that used in the intact enamel studies should also be included. In this series the enamel was stored with a disk of the material rather than just the filtrate. Although use of this method demanded great care in the handling of disks to prevent small fragments from fracturing off and thus contaminating the enamel sample, it offered other advantages. It allowed the water on the specimen to be changed daily; hence, eliminating the possibility of the water becoming saturated by the products of dissolution which could inhibit or reduce further solution of the material.

In preparing the disks, definite weights of the materials were again mixed with appropriate quantities of the liquids. The

48. Battistone, G. C., and Burnett, G. W. Studies of the composition of teeth. III. The amino acid composition of human dentinal protein. J. D. Res. 35:255 April 1956.

Table 1 • Average change in solubility of intact enamel surfaces induced by silicate cements (two weeks)

Silicate	Av. change in calcium solubility (%)
S. S. White	−27.5
deTrey's	−22.8
Ames Berylite	+20.4

mix was placed on a glass slide and another slide placed on top. Pressure was applied so that the cement was squeezed out to form a disk 20 mm. ± 1.0 mm. in diameter. The weight of silicate and zinc phosphate cement powders used in the preparation of the disks was 0.5 Gm. Only 0.3 Gm. of powder was required to form resin disks of the same size.

Three minutes from the start of the mix, the disk was stored in a humidifier at 100 per cent humidity and after one hour was placed in a test tube containing 15 ml. of distilled water and 130 mg. of powdered enamel. Thus the powdered enamel was exposed to any fluoride which might be dissolving off the surface of the cement specimen. This disk was allowed to remain in the tube with the enamel for seven days. The water was drawn off each day and replaced with 15 ml. of fresh distilled water. After the seven days the disk was removed and the enamel washed thoroughly with distilled water and dried. A 100 mg. sample was then decalcified with acetic acid and calcium and phosphorus analyses run in the same manner as described in the previous test.

In all of these tests, storage of specimens was carried out at a constant temperature of 37°C., and the temperature used for drying was 100°C.

RESULTS

Silicate • The average change in the solubility of intact enamel surfaces as induced by the various silicate cements appears in Table 1. When S. S. White and deTrey's silicates were allowed to remain on tooth surfaces for two weeks, a noticeable reduction in calcium solubility was noted. According to the manufacturer, a fluoride flux is used in both of these products. Enamel surfaces covered with Ames Berylite, a silicate which contains no fluoride, demonstrated no decrease in the amount of either phosphorus or calcium dissolved by the acetic acid; rather there was an actual increase in solubility on these surfaces.

The individual data for 16 teeth tested with S. S. White silicate are given in Table 2, whereas results on the 25 teeth treated with the Ames material appear in Table 3. Some variation, of course, existed in the degree to which the solubility of individual teeth was influenced by the materials. The trend with each, however, was definite, and these individual variations merely emphasize the necessity of employing an adequate number of specimens when this type of test is employed.[41, 42]

Since both S. S. White and deTrey's silicates contain fluorides and their effect on the intact surface was comparable, only the S. S. White was used in the powdered enamel tests. The mean data

Table 2 • Data obtained in intact enamel tested with S. S. White silicate (two weeks)

Tooth no.	Control Ca-mg. %	Experimental Ca-mg. %	Difference mg.%	% Difference
1	0.913	0.757	−0.156	−17.1
2	1.177	0.828	−0.349	−29.7
3	1.143	1.051	−0.092	− 8.1
4	1.165	0.817	−0.348	−29.9
5	1.047	0.790	−0.257	−24.6
6	1.187	0.796	−0.391	−32.9
7	1.196	0.716	−0.480	−40.1
8	1.252	0.877	−0.375	−30.0
9	1.280	0.800	−0.480	−37.5
10	1.480	1.052	−0.428	−28.9
11	0.973	0.769	−0.204	−21.0
12	1.299	0.890	−0.409	−31.5
13	1.371	0.847	−0.524	−38.2
14	1.300	0.976	−0.324	−24.9
15	1.098	1.008	−0.090	− 8.2
16	1.374	0.869	−0.505	−36.8
			Av.	−27.5

Table 3 • Data obtained in intact enamel tested with Ames Berylite (two weeks)

Tooth no.	Control Ca-mg. %	Control P-mg.%	Experimental Ca-mg. %	Experimental P-mg.%	Difference Ca-mg. %	Difference P-mg.%	% Difference Ca	% Difference P
1	1.021		1.250		+0.229		+22.4	
2	1.305		1.436		+0.131		+10.0	
3	1.576	0.724	2.078	0.974	+0.502	+0.250	+31.9	+34.5
4	1.644	0.782	1.897	0.900	+0.253	+0.118	+15.4	+15.1
5	1.136		1.327		+0.191		+16.8	
6	0.968		1.129		+0.161		+16.6	
7	0.872		1.053		+0.181		+20.8	
8	1.058		1.363		+0.305		+28.8	
9	1.637	0.738	2.355	1.040	+0.718	+0.302	+43.9	+40.9
10	1.219		1.311		+0.092		+ 7.5	
11	1.219		1.458		+0.239		+19.6	
12	1.722	0.790	2.152	0.982	+0.430	+0.192	+25.0	+24.3
13	1.214		1.268		+0.054		+ 4.4	
14	1.126		1.340		+0.214		+19.0	
15	0.816		0.962		+0.146		+17.9	
16	1.240	0.582	1.716	0.760	+0.476	+0.178	+38.4	+30.6
17	1.093	0.528	1.392	0.634	+0.299	+0.106	+27.4	+20.6
18	1.117		1.377		+0.260		+23.3	
19	1.082		1.180		+0.098		+ 9.1	
20	1.268		1.371		+0.103		+ 8.1	
21	0.880		1.052		+0.172		+19.5	
22	1.119		1.133		+0.014		+ 1.3	
23	0.832		0.975		+0.143		+17.2	
24	1.044	0.520	1.346	0.602	+0.302	+0.082	+28.9	+15.8
25	1.169	0.556	1.607	0.728	+0.438	+0.172	+37.5	+30.9
					Av.		+20.4%	+26.5%

from the various tests using powdered enamel are given in Table 4. As with the intact surface, a definite reduction in solubility was found with S. S. White silicate when either the disks or the filtrate was employed. Contrary to the results found with the intact enamel, Berylite decreased somewhat the solubility of powdered enamel. This particular phenomenon of certain materials increasing the solubility of intact enamel but reducing very slightly the solubility of powdered samples was observed throughout the tests and will be discussed later in this paper.

Resins • The effect on intact enamel of two commercial products—Kadon, a resin which contains no fluoride and FluorOn, one which contains both sodium and stannous fluoride—was measured. Three experimental resins, one containing 5 per cent sodium fluoride, one 2 per cent sodium fluoride and one 2 per cent stannous fluoride, were also studied.

The average change in the calcium solubility of enamel surfaces after two weeks' treatment with these materials can be seen in Table 5. A definite reduction was noted in the solubility of surfaces

Table 4 • Mean data from various tests on powdered enamel in which silicate cement was used

Type of silicate	Av. change in solubility: 1 week-disk Ca(%)	1 week-disk P(%)	1 day-filtrate Ca(%)	1 day-filtrate P(%)	3 days-filtrate Ca(%)	3 days-filtrate P(%)
S. S. White	−33.6	−31.9	−29.1	−28.7	−37.9	−36.8
Ames Berylite	−11.8	−10.7	− 8.9	− 8.9	−12.6	−15.6

Table 5 • Average change in calcium solubility of enamel surfaces after two weeks' treatment with resin cements

Resin	Av. change in Ca solubility
	%
Resin +5% NaF	−17.4
Resin +2% NaF	−22.9
Resin +2% SnF_2	−24.0
FluorOn	−53.3
Kadon	+18.5

treated with each of the experimental products to which the fluorides were added. Little difference was detected in the effect of the various compositions. The commercial product, FluorOn, resulted in a considerable reduction in solubility, greater than that found for the silicates. The quantities of stannous fluoride and sodium fluoride present in this product were not determined. When teeth were subjected to Kadon, a resin which contained no fluoride, the surface solubility was again increased.

Individual data for teeth treated with FluorOn and Kadon appear in Tables 6 and 7 respectively. Similar results were obtained after two weeks' exposure to each of the experimental resins, the individual data for one of these, the 5 per cent sodium fluoride, are given in Table 8. Although it will again be noted that the changes in individual teeth are not always of the same magnitude, for a given material the tendency to either increase or decrease solubility was the same for each specimen.

The average per cent change in phosphorus and calcium solubility of powdered enamel samples tested with these materials is shown in Table 9. The two resins which contained 2 per cent and 5 per cent sodium fluoride appeared to produce approximately the same change in enamel solubility. As with the intact surfaces, the reductions in the solubility of samples after treatment with FluorOn were exceedingly high. Even though intact teeth on which Kadon had been placed gave evidence of a definite increase in enamel solubility, the solubility of powdered samples appeared to be altered very little when treated with this material.

Zinc Phosphate Cement • The manner in which the zinc phosphate cements influenced the solubility of intact enamel can be seen in Table 10. One commercial product, S. S. White, increased the solubility of the intact surfaces very slightly. The other two cements used were specially prepared experimental batches. Ten per cent calcium fluoride was burned into one batch. (Calcium fluoride was used in this preliminary series, rather than sodium fluoride, since this compound is generally used as the flux in the manufacture of silicate cements and would thus serve as a better comparison.) The second batch was prepared in the same manner except that no fluoride was added; hence, this material served as the control for the fluoride-added cement.

Although the per cent increase in solubility was greater with this experimental control material than with the commercial product, these results should not be

Table 6 • Data obtained for intact enamel treated with FluorOn (two weeks)

Tooth no.	Control Ca-mg. %	Experimental Ca-mg. %	Difference mg. %	% Difference
1	1.733	0.701	−1.032	−59.4
2	1.713	0.685	−1.028	−60.0
3	1.346	0.685	−0.661	−49.1
4	1.462	0.587	−0.875	−59.8
5	1.334	0.691	−0.643	−48.2
6	1.466	0.697	−0.769	−52.5
7	1.684	0.657	−1.027	−61.0
8	1.600	0.710	−0.890	−55.6
9	1.097	0.469	−0.628	−57.2
10	1.296	0.622	−0.674	−52.0
11	1.188	0.608	−0.580	−48.8
12	1.292	0.656	−0.636	−49.2
13	1.409	0.780	−0.629	−44.6
14	0.955	0.468	−0.487	−51.0
15	1.281	0.636	−0.645	−50.4
			Av.	−53.3

Table 7 • Data obtained for intact enamel treated with Kadon (two weeks)

Tooth no.	Control Ca-mg. %	Experimental Ca-mg. %	Difference mg. %	% Difference
1	0.973	1.078	+0.105	+10.8
2	0.968	1.286	+0.318	+32.9
3	1.073	1.234	+0.161	+15.0
4	0.957	1.180	+0.223	+23.3
5	1.084	1.211	+0.127	+11.7
6	0.779	1.000	+0.221	+28.4
7	1.049	1.136	+0.087	+ 8.3
8	0.978	1.022	+0.044	+ 4.5
9	1.192	1.418	+0.226	+19.0
10	1.174	1.307	+0.133	+11.3
11	0.930	1.178	+0.248	+26.7
12	0.886	1.215	+0.329	+37.1
13	1.148	1.262	+0.114	+ 9.9
14	1.056	1.163	+0.107	+10.1
15	1.173	1.331	+0.158	+13.5
16	1.069	1.421	+0.352	+32.9
			Av.	+18.5

Table 8 • Results obtained in intact enamel after two weeks' exposure to resin containing 5 per cent sodium fluoride

Tooth no.	Control Ca-mg. %	Experimental Ca-mg. %	Difference mg. %	% Difference
1	1.229	0.942	−0.287	−23.4
2	0.988	0.931	−0.057	− 5.8
3	1.265	0.987	−0.278	−22.0
4	1.331	1.036	−0.295	−22.2
5	1.190	1.076	−0.114	− 9.6
6	1.061	0.854	−0.207	−19.5
7	1.161	0.939	−0.222	−19.1
8	1.303	1.088	−0.215	−16.5
9	1.284	1.169	−0.115	− 9.0
10	1.123	0.935	−0.188	−16.7
11	1.071	0.889	−0.182	−17.0
12	1.021	0.876	−0.145	−14.2
13	1.213	1.027	−0.186	−15.3
14	1.208	1.005	−0.203	−16.8
15	1.534	1.122	−0.412	−26.9
16	1.345	1.027	−0.318	−23.6
			Av.	−17.4

compared. The experimental batches were burned at a temperature much lower than that generally used in the manufacture of zinc phosphate cements, and it could be expected that the physical properties of the two materials would be quite different. When the surfaces were exposed to the cement containing 10 per cent calcium fluoride, the increased solubility was negligible. Although no decrease was noted, the difference between the control and the fluoride-containing material was evident.

The results on powdered enamel with this group of materials can be seen in Table 11. Use of cements containing 5, 10 and 15 per cent calcium fluoride reduced calcium and phosphorus solubility approximately the same amount. From these data, however, it would seem that the addition of calcium fluoride, at least at these concentrations, does not produce a very great influence on enamel solubility. Higher concentrations and use of other fluoride compounds might have a more noticeable effect.

Table 9 • Average percentage change in phosphorus and calcium solubility of powdered enamel samples tested with restorative resins

Type of resin	Av. change in solubility—(%) 1 week-disk Ca	1 week-disk P	1 day-filtrate Ca	1 day-filtrate P	3 days-filtrate Ca	3 days-filtrate P
Resin +5% NaF	−19.0	−20.7	−21.9	−27.8	−18.6	−26.8
Resin +2% NaF	−19.8	−19.7	−22.0	−25.5	−19.6	−20.6
Resin +1% NaF	−13.7	−14.8	−14.0	−19.8	−12.0	−21.7
Resin +0.5% NaF	−10.4	− 9.4	−14.3	−20.1	−16.0	−21.5
Resin +0.05% NaF	− 4.9	− 3.8	−13.7	−17.4	− 4.2	− 8.8
FluorOn	−45.3	−50.0	−61.0	−63.5	−62.7	−73.5
Kadon	0.0	− 5.6	+ 0.5	− 8.2	+ 0.9	−14.1

A summary of the results obtained with the various materials which reduced the solubility of the intact surface can be seen in Figure 1. It will be noted that the reduction in calcium solubility after treatment for 16 minutes with a 2 per cent aqueous, unbuffered sodium fluoride solution is also plotted. Although other tests made in this laboratory have shown greater reduction when the treatment period for this solution was increased, 16 minutes was selected for comparison since it represents the accumulated time recommended and proved beneficial for topical application. This summary shows that after two weeks' contact with the enamel surface, most of the fluoride-containing material caused reduction in solubility as great or greater than the aqueous solution.

A summary of the effects of both the disks and filtrates from the various materials containing fluoride on powdered enamel appears in Figures 2 and 3 respectively. These effects are compared with the reduction in solubility induced by treatment of the powdered enamel samples for 16 minutes with a 2 per cent aqueous, unbuffered sodium fluoride solution. With few exceptions, the materials seemed to decrease the solubility as effectively as did the sodium fluoride solution.

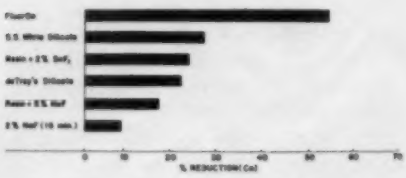

Fig. 1 • Solubility of intact enamel (two weeks)

Since all studies on intact surfaces had been carried out over a two week period, it was felt that the rapidity with which the material affected enamel solubility should be investigated. Two types of materials which had proved effective in reducing the solubility over the two week period were selected for this study—the S. S. White silicate and the resin which contained 5 per cent sodium fluoride. These materials were placed on the surfaces of 130 teeth. At various time intervals, ranging from one hour up to one month, the materials were removed from groups of eight teeth and solubility measurements made. The mean data for these series of experiments are plotted in Figure 4. The silicate cement attained its maximum effectiveness after two weeks. The action of the sodium fluoride resin was more rapid, although the final reduction was not so great as that obtained with the silicates. No further decrease in the solubility of surfaces treated with this material was observed beyond the two and a half day period.

Table 10 • Influence of zinc phosphate cements on solubility of intact enamel (two weeks)

Cement	Av. change in Calcium solubility
	%
S. S. White	+ 7.2
Cement + 10% CaF_2	+ 2.2
Cement—No F added	+26.6

Table 11 • Results obtained in powdered enamel when experimental batches of zinc phosphate cement were used

Type of cement	Av. change in solubility			
	1 week-disk		1 day-filtrate	
	Ca	P	Ca	P
	%	%	%	%
Zn Phos. + 15% CaF_2	−8.3	−12.8	− 7.6	−13.5
Zn Phos. + 10% CaF_2	−9.5	−12.8	− 9.3	−13.8
Zn Phos. + 5% CaF_2	−8.0	− 9.2	−10.6	−14.8
Zn Phos. (No F)	−0.5	− 4.2	− 2.4	− 7.3

DISCUSSION

The results of this investigation indicate clearly that the fluoride present in commercial silicates reduces the solubility of the adjacent enamel. All of the data, with

both powdered and intact enamel surfaces, substantiate this observation. The mechanism is then in reality somewhat comparable to the topical action of a fluoride solution.

This finding must not be construed as the sole explanation for the lowered incidence of recurrent caries around that type of restoration. In view of the recent work of Lilienthal,[27,28] however, which showed little, if any, antienzymatic action of the fluoride ion at low concentrations, it is suggested then that the solubility-reduction mechanism would seem to be the more dominant. Certainly the lack of evidence to support any definite antibacterial effect of any of the materials which were studied in this investigation and the difficulties associated with the addition of such agents, make the development of materials which might reduce enamel solubility a bright avenue for future research. This is particularly true in the fluoride field, since the reduction in dental caries effected by topical application of fluorides has invariably been associated with a reduction in the solubility of the inorganic phase of the tooth.

It is apparent that fluorides, in reasonably low concentrations, can be added to dental materials which have little or no antibacterial properties in order to bring about a substantial reduction in enamel solubility; thus they might be of decided value in minimizing the possibility of recurrent caries at the critical marginal regions. The addition of sodium and stannous fluoride to acrylic resins and, to a lesser degree, the use of calcium fluoride with zinc phosphate cement produced a reduction in enamel solubility of approximately the same magnitude as that induced by use of a 2 per cent aqueous solution of sodium fluoride. These data, however, must not be construed as a recommendation by the authors of a material such as FluorOn, or that the experimental materials developed in this study are suggested for clinical use. There

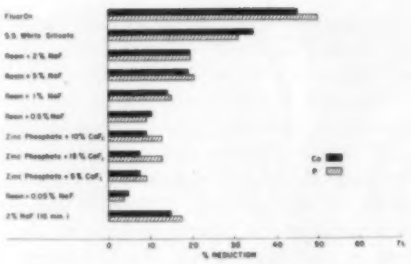

Fig. 2 • Solubility of powdered enamel (one week—disk)

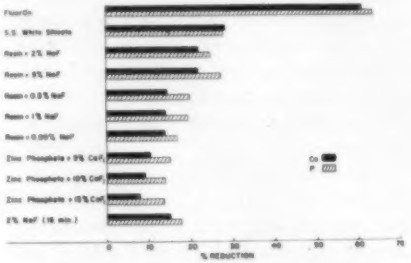

Fig. 3 • Solubility of powdered enamel (24 hours—filtrate)

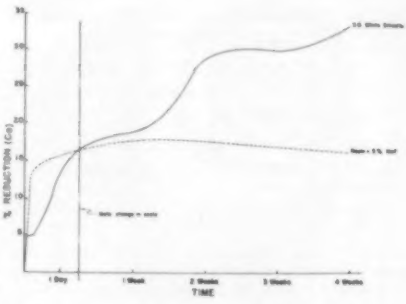

Fig. 4 • Rate of reduction in solubility of intact enamel

are many factors which must be considered other than the ability of the material to reduce the solubility of enamel. Certainly the necessary physical properties, such as minimum solubility, high

strength and normal setting time, must be maintained in the final product if it is to be successful clinically.

One of the essential considerations is the effect of the material on the dental pulp. Histological studies must be carried out to determine whether the added fluoride is injurious. Some early work indicated that when high concentrations of sodium fluoride were sealed in cavity preparations, severe injury occurred.[49] However, recent studies with "aquadont," which contained up to 4 per cent of sodium fluoride,[50] and with aqueous solutions of 4 per cent sodium fluoride,[50,51] indicated little harm to the pulps of rats. Both of these investigations suggested that the addition of fluoride to restorative materials or the use of topically applied solutions to the cavity preparation might be a safe procedure. It must be recognized, however, that much work will be required to determine the effects of both stannous and sodium fluoride when added to each material, the maximum concentrations that could be utilized, the best manner of incorporating the fluoride, the amount of available fluorine and the actual uptake of fluorine by the tooth. These problems are only a few of the variables to be studied before a satisfactory restorative or cementing material can be developed. This research is now under way, and the present report merely indicates the mechanism which is possible.

One of the surprising findings in this investigation was the increased solubility of the intact enamel surface when treated with all of the materials which contained no fluoride—resin, Berylite and zinc phosphate cement. This observation was not confirmed with the powdered enamel series, as most of these same materials produced a slight reduction in solubility, although never of the magnitude attained with the fluoride-containing materials. The results with the powdered enamel are understandable, however. Although the enamel was most thoroughly washed after its treatment with the filtrate, small tenacious deposits from the solution might remain on each particle and offer some protection against the subsequent acid decalcification. Likewise, any attack by the filtrate could leave an etched surface that would somewhat inhibit the action of the acid.

This explanation is not valid for the intact surface since the region was thoroughly repolished after the material was removed. It is possible that the organic part of the surface is attacked by some of the materials,[52] thereby facilitating penetration of the acid. At any rate, this increased solubility with the nonfluoride materials is definite, and further studies to determine the cause are planned.

It would seem that this approach of developing a dental material which would, by reaction of a chemical such as a fluoride with the enamel, actually increase the resistance of the surrounding tooth structure to acid attack has certain advantages over merely incorporating germicidal agents in the material. It is apparent that this reaction occurs fairly rapidly after placement of the material, and once it has reached its maximum effect there is no need to have the added agent continually liberated at the surface of the material as is the case when germicidal agents are employed. The protection at the critical marginal regions has been accomplished, and continued solubility of the material is probably neither necessary nor desirable. Of course, it is possible that certain of these ions which are taken up by the tooth, such as tin,

49. Lefkowitz, W., and Bodecker, C. F. Sodium fluoride: its effect on the dental pulp. Ann. Den. 3:141 March 1945.

50. Maurice, C. G., and Schour, I. Effects of sodium fluoride upon the pulp of the rat molar. J. D. Res. 35:69 Feb. 1956.

51. Perreault, J. G.; Massler, M., and Schour, I. Reaction of odontoblasts to medicaments placed in cavity preparations in rat incisors. J.A.D.A. 52:533 May 1956.

52. Crabtree, M. G., and Atkinson, H. F. A preliminary report on the solubility of decalcified dentine in water. Austral. J. Den. 59:340 Dec. 1955.

might have the added effect of being acid inhibitors.[53]

SUMMARY

An investigation has been made of the effects of certain dental materials on the solubility of enamel. Both powdered enamel and intact surfaces were employed, and the solubility determined by means of calcium and phosphorus measurements after treatment of the enamel with acetic acid. Analysis of results obtained on over 600 individual specimens and 2,000 chemical analyses led to the following conclusions:

1. Commercial silicate restorative materials produce a considerable reduction in enamel solubility. This reduction may be attributed to the fluoride present in the silicate.

2. It is probable that the lower incidence of recurrent caries generally found around the silicate restoration can be attributed, to a great extent, to this increased resistance of the surrounding tooth structure to acid attack.

3. The rate of reaction of the fluoride in the silicate with the intact enamel is fairly rapid, being measurable at five hours and apparently reaching a maximum at the end of two weeks.

4. All of the materials which contained no willfully added fluorides—resin, zinc phosphate cement and silicate—actually increased the solubility of the intact enamel surface.

5. Experimental resins containing added amounts of either sodium fluoride or stannous fluoride, zinc phosphate cement containing calcium fluoride and one commercially available resin containing both sodium fluoride and stannous fluoride, reduced enamel solubility to varying degrees.

Although much chemical and histological research must be completed before a fluoride-containing material could be recommended for dental use, the mechanism which has been proved opens a promising field for the development of certain materials that could offer definite protection against recurrent caries.

53. Lilienthal, B. Inhibition of acid formation from carbohydrates by stannous fluoride and stannous chlorofluoride. Austral. D. J. 1:165 June 1956.

Text Books • There is nothing more valid than the advice that everyone should go back to his school-books every thirty years. . . . Despite the disconcerting torrential progress of learning today, there are certain invariable starting-points without which all the latest erudition is a flower that lasts but a day. *G. Maranon, Crítica de la medicine dogmatica.*

Methods for evaluation of rotating diamond-abrasive dental instruments

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There has been a widespread tendency toward increased use of diamond instruments as a result of the higher rotational speeds of handpieces now available to the dental profession. Recent work[1,2] has indicated that diamond abrasive instruments operate more efficiently than steel or carbide burs in the removal of tooth enamel. Ingraham's work[3] provides a more efficient method and one which utilizes modern instrumentation for the rapid removal of hard tooth structures. There have been many reports of unsatisfactory and inconsistent performances of these instruments, however.

Examination of diamond instruments that had been discarded after clinical operative procedures showed that a breakdown of the bonding mediums, with resultant loss of the diamond abrasive, occurs in clinical use. It was observed that there was consistent loss of the abrasive at the relatively small areas or points of the instrument such as A and B in Figure 1 which receive the greatest loading per unit area in use. The other surfaces of the instruments showed little or no loss of the abrasive. This breakdown in a limited area of the instrument occurs more frequently with diamond than with other abrasive instruments because the diamond instruments are used to cut exacting angles, grooves and bevels in operative or crown and bridge dentistry and therefore are not so made that they change shape and expose new abrasive material as they wear down. The necessary use of small, specifically shaped instruments results in low peripheral speeds, even at the higher rotational speeds available today. During the preparation of an exacting cut at these low peripheral speeds, the instrument is subjected to repeated high pressures in certain areas; thus, breakdown of the bonding medium and loss of diamonds occurs.

Because of this breakdown, an instrument should be evaluated for its ability to resist loss of the abrasive. It was believed that an accelerated test, using a material such as glass, would determine the ability of a diamond instrument to retain its abrasive particles under the

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§Physicist, dental research section, National Bureau of Standards.

1. Peyton, F. A. Temperature rise and cutting efficiency of rotating instruments. New York D. J. 18:439 Nov. 1952.

2. Hudson, D. C., and others. Factors influencing the cutting characteristics of rotating dental instruments. J.A.D.A. 50:377 April 1955.

3. Ingraham, Rex, and Tanner, H. M. Adaptation of modern instruments and increased operating speeds to restorative procedures. J.A.D.A. 47:311 Sept. 1953.

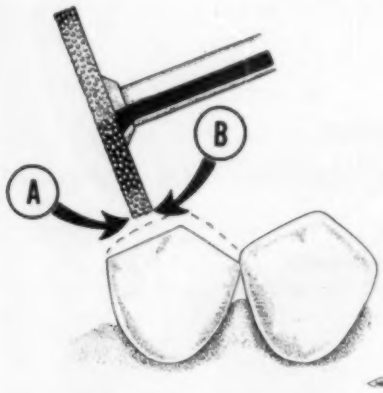

Fig. 1 • Clinical use of diamond wheels. Points A and B indicate areas of this diamond wheel which would receive the highest pressures per unit area resulting in breakdown of the bonding of the abrasive to the instrument

harsh conditions necessarily encountered in clinical use. An investigation of the use of glass as a test material for evaluating diamond abrasive instruments was therefore undertaken. Measurements were made on diamond cylindrical instruments cutting Pyrex rods and on diamond wheels cutting glass plates and tooth enamel.

EXPERIMENTAL PROCEDURE AND RESULTS

A weight-loss method was utilized to compare the cutting effectiveness of various brands of diamond instruments. A machine with accessory timing and controlling features which had been designed and constructed at the School of Aviation Medicine, Randolph Air Force Base, Texas, was modified for use in this study. On this machine, a movable platform which held the material to be cut could be brought automatically under predetermined loads to a precision spindle and draw-collet chuck for the diamond instrument. Cutting application and release were controlled accurately by an electronic interval timer through an electromagnet and spring mechanism.

Pyrex glass rods, a quarter of an inch in diameter (Fig. 2) were selected as the test material for the 3/32 inch cylindrical diamond instruments first evaluated. The measure of cutting rate was obtained by determining weight loss of the Pyrex rod after a fixed interval of cutting time at a specific load. Speeds of 3, 5, 10 and 15 thousand revolutions per minute with a load of 400 Gm. were employed.

The cutting cycle consisted of making a series of three, five-second cuts at the same point on the rod, then shifting to a new area, where the cycle of three cuts was repeated. After four such cutting cycles or a total of one minute, the specimen (Fig. 3) was removed and weighed. This procedure was repeated at the end of each minute of cutting for a total of five minutes. Beyond this point and up to a total of 25 minutes, weight loss was determined at the end of each five minutes of cutting. The weight loss in milligrams per minute during cutting time will hereafter be referred to as the cutting rate.

Specimens of ten brands of 3/32 inch cylindrical diamond instruments were subjected to the test procedure. The

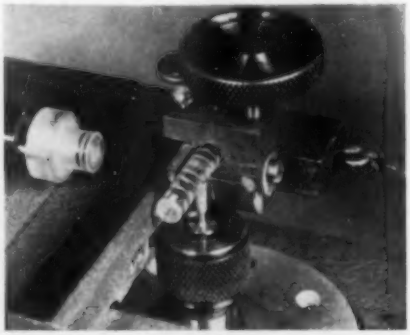

Fig. 2 • Specimen holder of test machine with Pyrex rod specimen in place. A movable platform is electronically controlled to bring the specimen into contact with the rotating diamond instrument for a predetermined period with a known load

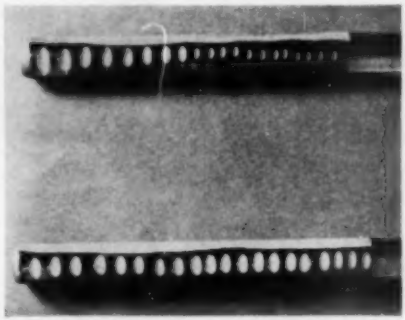

Fig. 3 • Pyrex rods used in evaluating cutting characteristics of 3/32 inch diamond cylindrical instruments. Above: Typical series of consecutive, 15 second cuts by a diamond instrument which rapidly lost its abrasive within the five minutes of cutting shown on the rod. Below: Typical series of 15 second cuts by an instrument which did not deteriorate rapidly in the five minutes of cutting shown. Speed, 5,000 rpm; load 400 Gm.

averages of the values for the five instruments of brand I, two of brands C and F and individual values for specimens of the other brands given in bar graph form in Figure 4, show the cutting rate over five minute intervals for 15 minutes. In all instances beyond this time, the instruments had deteriorated to the point that they were no longer effective in Pyrex.

In Figure 5 these same data are plotted to show the total material removed in 15 minutes of cutting at the four speeds. There was considerable variation in the performance of these instruments. When the speed was increased, those instruments in the higher performance group showed a general increase in amount of material removed during the 15 minute period. Instruments in the low performance group showed little if any increase in cutting.

Cutting rates in tooth enamel and in glass were determined for diamond wheels approximately ¼ inch in diameter by 1/16 inch in thickness. In order to

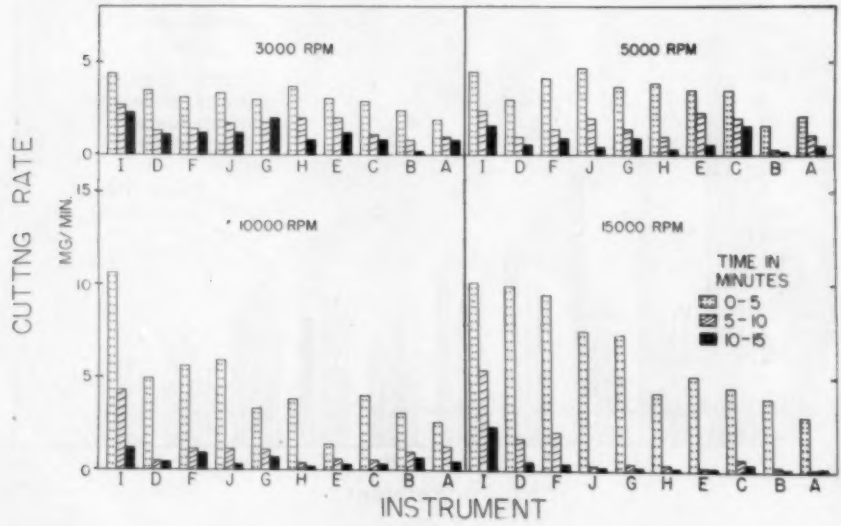

Fig. 4 • Cutting rates in Pyrex of ten brands of 3/32 inch cylindrical diamond abrasive instruments at 4 different speeds and at a load of 400 Gm. Note high cutting rate of instruments of brand I at all four speeds, and the low rate of instruments of brands A and B

prevent cutting through the enamel into the dentin during the cutting period, the load was reduced to 200 Gm. High initial contact pressure on the edges of the instruments such as occurs in clinical use was obtained by mounting the teeth as shown in Figure 6 so that the cut was at approximately 45 degrees to the enamel surface.

In order to provide a common basis for comparative results, rotational speed was adjusted to provide a constant peripheral rate of travel for all brands. This was 450 feet per minute at approximately 5,000 rpm and 900 feet per minute at approximately 10,000 rpm. Each instrument tested was subjected to a total cutting time of ten minutes. A different tooth was used for each minute of cutting. Twelve, five-second cuts were made, each cut on a new area of the tooth surface. Each tooth was weighed before and after the cutting cycle of one minute. The results obtained are shown in Figures 7 and 8.

There was no apparent breakdown of the bonding of the abrasive while cutting enamel under the conditions of this experiment. The cutting rate remained essentially the same during the ten minute period. Instruments of two brands were therefore subjected to longer cutting periods. An instrument of brand I from the outstanding performance group and an instrument of brand B from the low performance group were run for 140 minutes in enamel. As shown in Figure 9, the cutting rates of both instruments remained essentially constant during this period.

The instruments which had been run in enamel were re-run at 450 and 900

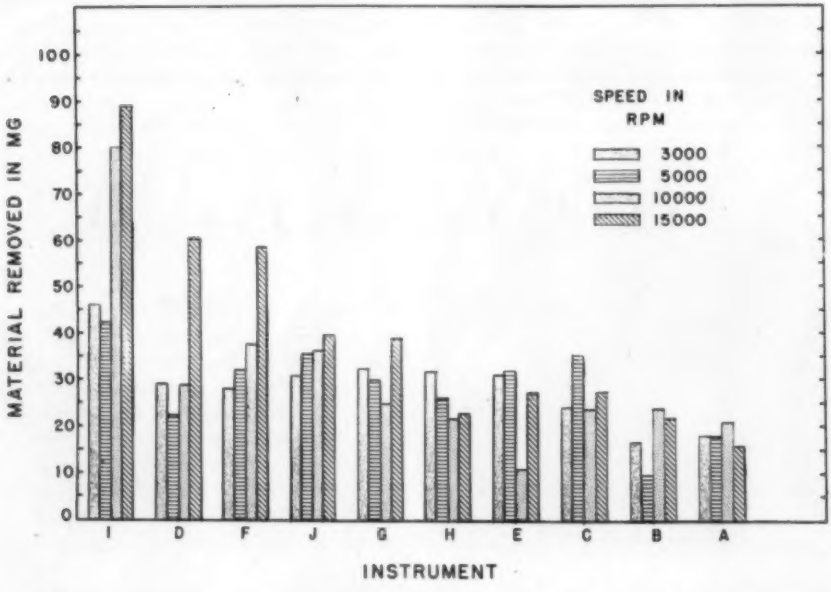

Fig. 5 • Total material removed by 3/32 inch cylindrical diamond instruments at 3,000, 5,000, 10,000 and 15,000 rpm and 400 Gm. load. Note that high-cutting-rate diamond instruments at the left removed more material as the speed of rotation was increased, but that those instruments at the right did not

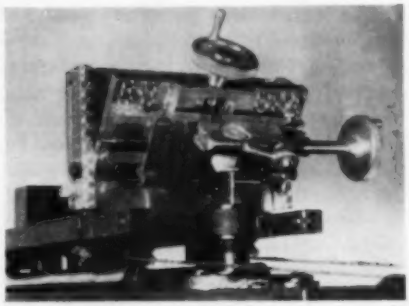

Fig. 6 • Apparatus on movable platform for holding and shifting human tooth specimens in weight-loss determination for relative cutting rates of one-quarter-inch diamond wheels. Controls adjust locking and horizontal and vertical movement of tooth

feet per minute in ⅛ inch thick window glass. The angle of cutting was 45 degrees (Fig. 10). The procedure consisted of making a series of three, five-second cuts at a 200 Gm. load in each new location on the specimen. The glass was weighed before and at the end of each minute of cutting during the first five minutes, then after every five minutes for a total of 20 minutes. The data were plotted for the first five minutes only because breakdown of all instruments occurred within this period (Fig. 7, 8).

DISCUSSION

It is believed that the peripheral speed attained by these instruments, because they are very small in diameter, is too low for optimum performance. Commer-

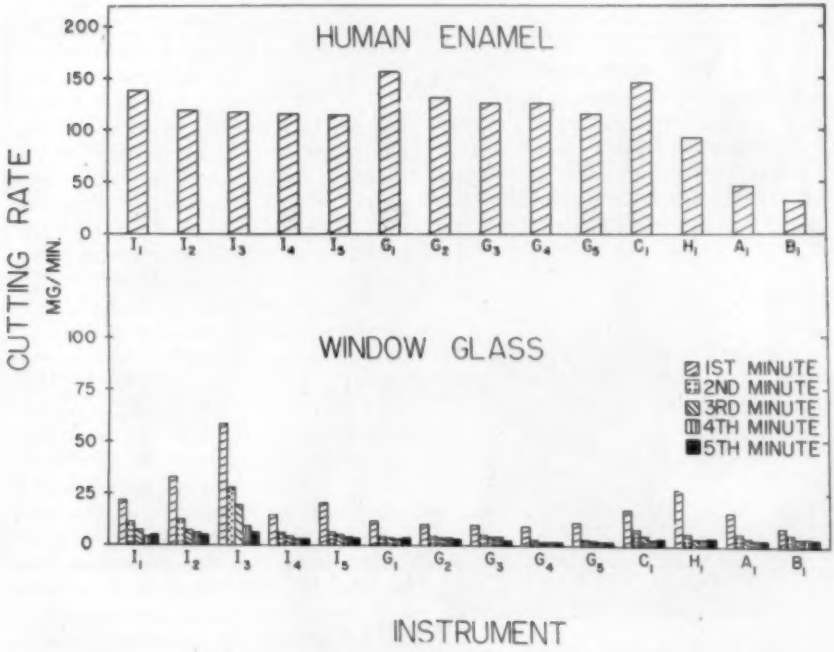

Fig. 7 • Cutting rates of 5,000 rpm and 200 Gm. load of one-quarter-inch diamond wheels in enamel and in window glass. Letters indicate brands; the subscripts indicate individual instruments of those brands

cial grinding practice with industrial wheels,[4] calls for a peripheral speed of from 5,000 to 7,000 feet per minute. Dental instruments only 3/32 of an inch in diameter have a peripheral speed of 360 feet per minute at 15,000 rpm. In order to obtain the recommended speed for commercial grinding practice, dental diamond abrasive instruments of this size would require rotational speeds of approximately 245,000 rpm.

The effect of speed of rotation on relative cutting rates is shown in Figures 4, 5, 7 and 8 and in the table. The values given in the table are based on the total amount of material cut by instruments of all brands during the cutting periods and at the speeds indicated. When the speed of the cylindrical instruments was increased, the cutting rate in Pyrex was also increased for most instruments. As would be expected, however, those instruments which deteriorated rapidly showed little, if any, increase in effectiveness at the higher speeds. When the speed of the ¼ inch wheels was increased from 5,000 to 10,000 rpm, the cutting rate in enamel increased on the average by a factor of two. For most of the wheels the cutting rate in window glass was increased by a factor of three when the speed was doubled.

No close correlation between the performances of diamond instruments in enamel and in glass can be seen in Figures 7 and 8. In general, particularly at 10,000 rpm, instruments which had high cutting rates in glass, brand I, also

4. Kent, William. Mechanical engineers handbook, ed. 12, vol. 2, sec. 23. New York, John Wiley and Sons, Inc., 1950.

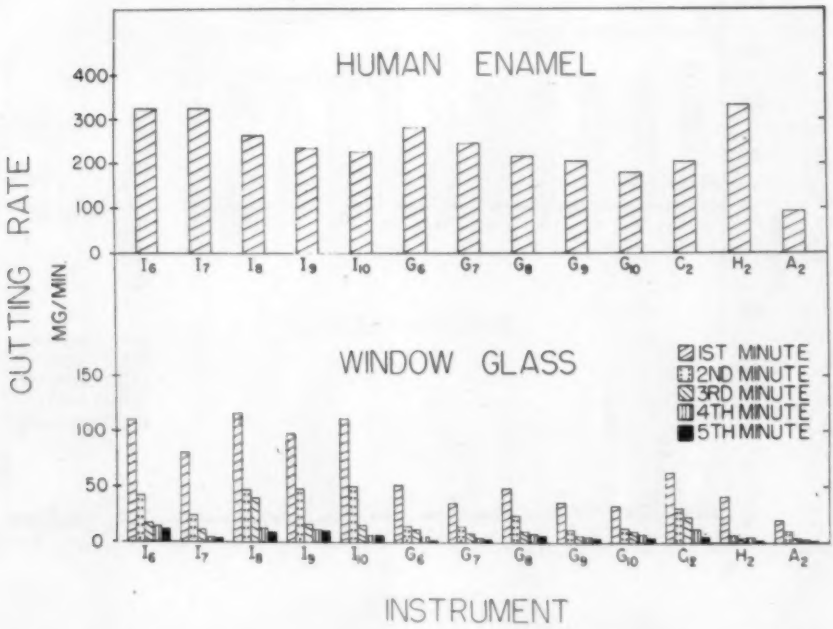

Fig. 8 • Cutting rates at 10,000 rpm and 200 Gm. load of one-quarter-inch diamond wheels in enamel and in window glass. Letters indicate brands; the subscripts indicate individual instruments of those brands

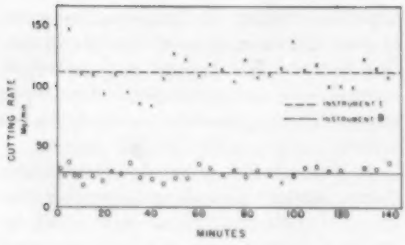

Fig. 9 • Comparison of cutting rates in enamel at 5,000 rpm and 200 Gm. load of an instrument of brand I which had a high cutting rate in glass, and one of brand B, which had a low rate of cut. Neither instrument attained the breakdown point in enamel within this 140 minute period

had high cutting rates in enamel. Instruments with relatively low cutting rates in enamel such as A and B had low cutting rates in glass. There were also, however, a number of instruments G, C and H which showed, under the conditions employed in this study, high cutting rates in enamel and rather low rates in glass.

It should be emphasized that the cutting of glass results in an evaluation made under severe conditions of heavy loading on a material that is unlike enamel in structure. Glass is homogeneous and is considerably harder than human enamel. Knoop hardness for the Pyrex glass used was approximately 450 and for the window glass was approximately 510. Human enamel hardness was found to be Knoop 300 to 340.

Analysis of the glass-cutting test indicates that it is, in effect, an accelerated breakdown test, wherein the material cut is considerably more destructive to the diamond instruments than is human enamel. This causes a loss of the diamond abrasive and the strength of the bond between the diamonds and the head of the instrument is thereby evaluated. It is probable, therefore, that results of the glass-cutting test are more closely related to the clinical breakdown of diamond instruments than to the cutting rate in enamel before breakdown. Although breakdown occurs in clinical use, no data are available on which a comparison of the results of cutting in glass and clinical experience could be made.

It is believed that, in a specification for diamond instruments, a glass-cutting test could be used for determining the resistance of the instruments to loss of abrasive. For determining the cutting rate, a different test material, probably one which does not cause breakdown, should be used.

CONCLUSIONS

1. There is a wide variation in the cutting ability of diamond instruments under the conditions of these experiments.

2. The more durable cylindrical instruments cutting Pyrex removed a greater amount of material as rotational speed was increased. The less durable cylinders demonstrated little or no improvement in performance at the higher speeds. The cutting rates of most of the ¼ inch diamond wheels were doubled in enamel and were more than doubled in window glass when the speed of rotation was increased from 5,000 to 10,000 rpm.

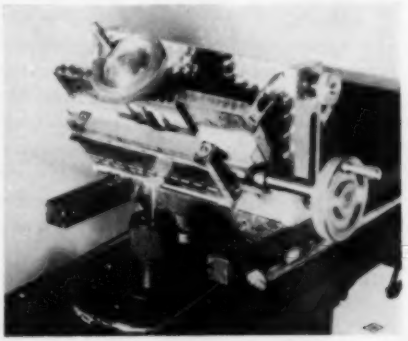

Fig. 10 • Specimen holder for one-by-three inch common window glass specimens, mounted on movable platform of rotating-instrument evaluating machine. Note 45 degree angle of cut

Table • Relative cutting rates of diamond instruments at different speeds

Instrument	Material cut	Relative cutting rate			
		3,000 rpm	5,000 rpm	10,000 rpm	15,000 rpm
Cylinders	Pryex rods*	0.9	1.0	1.5	2.0
Wheels	Window glass*		1.0	3.0	
Wheels	Tooth enamel†		1.0	2.0	

*Five minute cutting period.
†Ten minute cutting period (cutting rate remained constant in enamel).

3. Close correlation of the relative cutting rates of diamond instruments in glass and enamel was not obtained under the conditions of this experiment. The breakdown which occurred in glass was not produced in up to 140 minutes of cutting in enamel. Those instruments that were outstanding in cutting glass were, in most instances, also outstanding in cutting enamel. The poorest instruments in enamel were also relatively ineffective in glass. All instruments were erratic in behavior.

4. Breakdown of these instruments occurs under clinical use, possibly because of their small size which results in low peripheral speeds and high pressures on specific areas of the instruments. This breakdown is due to failure of the bonding medium with resultant loss of the diamond abrasive.

5. In the evaluation of the relative cutting effectiveness of dental diamond instruments, a test of the bonding medium should be included. It is believed that such a test can be based on cutting effectiveness in glass.

Muscular changes associated with temporomandibular joint dysfunction

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During the past few years the dental profession has shown increasing interest in the physiology of occlusion and the temporomandibular joint. These subjects are properly within the scope of dentistry, hence a thorough understanding of their many problems is a practical necessity for the successful practice of present-day dentistry.

The temporomandibular joints are paired structures about which the mandible moves, as a single unit, in function. The mandible is set in motion by the attached voluntary musculature after this musculature is suitably stimulated by nervous impulses to produce functional movements. The range of these various movements is controlled, guided, and limited by teeth, joint structure, nerves, muscles and ligaments.

Too often in their endeavors to restore oral health, dentists are oblivious of the whole patient and direct their efforts to special dental problems—the placement of a single inlay or bridge, or the orthodontic correction of the teeth into an acceptable anatomic arrangement.

In the dentist's efforts to establish

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anatomic normalcy, he often forgets the principles of physiology—"how" and "why" all of these various parts are anatomically interrelated to achieve function. Too often knowledge of basic science is eclipsed by the pragmatism of office efficiency. This shortsightedness results in a neglected service to the total needs of the patient.

Dentistry has made great strides in the fields of dental materials, improved cutting methods, local anesthetics, control of dental decay and oral rehabilitation; in short, the dentist can well manage the structures he sees. A certain percentage of patients, however, present themselves with problems of pain, malaise and poorly defined complains of discomfort. The suffering some of these patients have endured and the future pain they may suffer when they leave the dentist's office without an attempt by the dentist to help them may not be realized. Often the patients are conveniently classified as neurotics.

The primary purpose of the research reported in this paper was to chart the pain patterns of several of these patients so that the information so derived could be utilized in studying the topographic distribution and nature of temporomandibular joint pain.

It would be a bold assumption to think that all of the pain in the head or neck is of dental origin; but certainly it would be safe to say that more of it is due to dental causes than is realized.

The orthodontic department of Northwestern University Dental School has long been concerned with functional problems of the occlusion and temporomandibular joints. Research studies by graduate students have been designed to enlarge the scope of understanding of the anatomy, physiology and pathology of this joint. In recent years a new instrument of investigation has been applied to the study of temporomandibular joint dysfunction. This instrument is called the "electromyograph." It is an electronic device which amplifies and records the minute electrical discharges of active voluntary muscle. A few of the working features of the device may be mentioned.

When muscle is active, numerous small electric discharges are emitted by the contracting fibers. If the changing characteristics of these discharges during function are to be studied, great amplification is necessary, since the currents discharged are less than a millionth of a volt. Electron tubes are set in circuit connections to form powerful amplification units. The current from the active musculature is led into the machine from the subject by means of electrodes.

There are two general classes of electrodes: the surface electrode, which is attached firmly to the skin overlying the muscle being investigated, and the needle electrode which may be inserted directly into the muscle (to record from various regions within one muscle rather than the mass of muscle which is recorded from under a surface electrode).

The electromyograph has supplied another useful adjunct in studying functional problems. When used in conjunction with the cephalometric roentgenogram and a careful clinical examination, many interesting features of oral function have been more thoroughly studied than was previously possible. A great deal of the material in this report is based on electromyographic findings of the past four years.

Lindblom,[1] several years ago, became interested in the problems of the temporomandibular joint as related to dentistry. In one of his early reports he successfully designed and described a roentgenographic means of studying the movements and positions of the mandibular condyle in function, and reported his findings obtained by utilizing this

1. Lindblom, Gosta. Technique for roentgen-photographic registration of different condyle positions in the temporomandibular joint. D. Cosmos 78:1227 Dec. 1936.

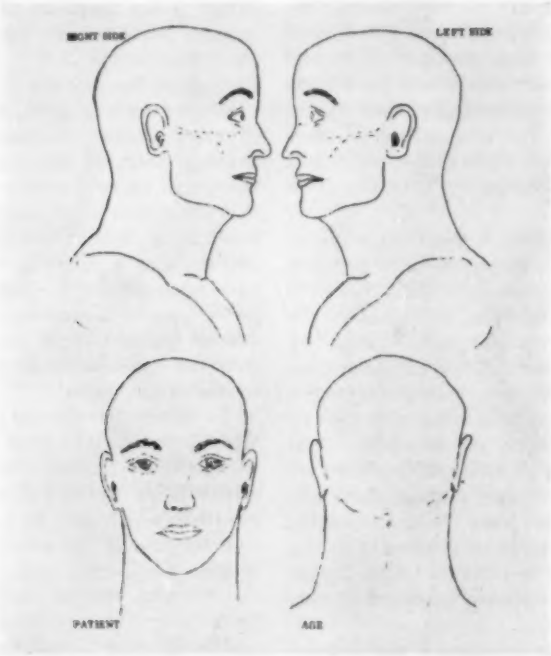

Fig. 1 • Printed form used to chart regions of patient's pain sensations

device. As early as 1935 Lindblom was roentgenographically comparing the condyle position with the teeth in occlusion.

The pain pattern of temporomandibular joint dysfunction has long been a neglected aspect of the problem. In the paper presented by Costen,[2] pain represented only one facet of the over-all picture.

The material presented in this paper is derived from 42 patients treated at the Northwestern University orthodontic department's temporomandibular joint clinic. The number of patients treated and observed in this special clinic exceeds this number many times; however, each one of these 42 patients had had one or more electromyographic examinations. Another 84 instances were taken from the private practice of J. R. Thompson, because of the completeness of his records. A few of the latter patients had also been investigated with the electromyograph. The total number of patients studied was 126. This seemingly is a small number from which to draw positive conclusions; however, the symptoms from both the objective and subjective viewpoints are so similar, in nearly every instance, that they do indicate a definite pattern.

Models, cephalometric and intraoral roentgenograms, functional wax records,[3]

2. Costen, J. B. A syndrome of ear and sinus symptoms dependent upon disturbed function of the temporomandibular joint. Ann. Otol., Rhin. & Laryn. 43:1 March 1934.

3. Thompson, J. R. Concepts regarding function of stomatognathic system. J.A.D.A. 48:626 June 1954.

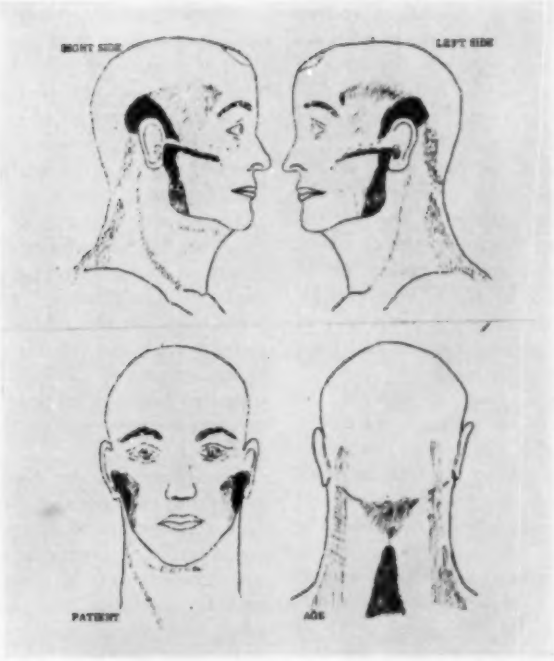

Fig. 2 • Composite chart indicating regions of most prevalent pain occurrence of the patients studied

pain distribution charts and complete functional examinations were obtained in each instance. Electromyographic records were taken in many instances. Tape recordings of the patient describing the subjective nature and distribution of the pain were taken of the clinic patients. In certain instances it was also desirable to examine the head of the condyloid process with temporomandibular joint roentgenograms by using the Donovan modification of the Lindblom apparatus.

Excluded from this report are all instances which may have developed as the result of severe traumatic injuries to the jaws or teeth. Insofar as it was possible to determine, all of the instances herein reported were due to problems of the occlusion.

The subjective symptoms of pain distribution were charted for each patient. Figure 1 shows the mimeographed form used. Chartings were made on each patient at the first appointment and all of the other records were completed at the same visit.

PATTERN OF PAIN

The pain charts were taken of each patient and the pain distribution charted on a large master-drawing, which formed a composite of the pain regions (Fig. 2). The master sheet gives a clear picture of the general region to which the patient suffering from occlusal disharmonies and temporomandibular joint dysfunction may ascribe painful sensations. The

darkest crosshatched regions, of course, represent those of most frequent pain occurrence. In some instances the zone of pain is not too widely distributed and may be limited to a small surface area of the face, cranium or neck.

The presence of the pain zones on the composite must not be interpreted as the total distribution pattern of any one patient but rather the mappings of many. It is doubtful that any one patient would complain of pain in all of these regions, for the usual patient is conscious only of pain in two or three locations and most frequently only unilaterally.

In the great majority of patients, the pain was minimal on arising in the morning. It increased in intensity as jaw movements occurred during the waking hours and often became so intense as to prevent comfortable mastication of food or normal talking. These latter complaints voiced by the patient, and other findings, particularly the topographical distribution of the pain on the charts of all of the patients, seemingly involved the voluntary musculature in the painful subjective sensation.

Vaughan[4] previously had mentioned the possible involvement of the external pterygoid muscle as a factor in this pain pattern.

Schwartz,[5] in a short but important description of temporomandibular joint pain, stated the possible means of muscle involvement and pain production.

Sicher[6] suggested that spasm in the muscles of mastication might or could produce the pain so commonly noted by patients with temporomandibular joint dysfunction and irregularities in their occlusion.

Utilization of electromyographic examination in diagnosis permits an evaluation of possible involvement of muscle as related to pain. All of the patients studied in the clinic were examined electromyographically during treatment and also after the corrective treatment was administered.

When a healthy, normally innervated, voluntary muscle is at rest, there are no signs of activity recorded by surface electrodes.[7] Should the slightest movement occur or the least bit of contraction take place, however, electrical discharges are "picked up" by the surface electrodes. This feature of muscle activity made possible the development of a method to establish the mandibular rest position by means of the electromyograph.[8] In that study cephalometric roentgenograms were made on the subject after the rest position had been established by the electromyograph; of 21 individuals studied only two failed to produce repetitive rest position roentgenograms that were identical.

Significant in the electromyographic recordings of these two patients was the fact that complete electrical inactivity could not be registered at any time while the mandible was in a supposed physiologic rest position. This particular finding went unexplored and unexplained for quite some time until functional wax records, as used by Thompson,[3] were utilized in examining the patients' occlusion. With this method of diagnosing occlusal interferences, the anatomically acceptable occlusions presented indications of functional disharmony. These two patients were re-evaluated after occlusal equilibration and within seven days the electromyographic recording of each patient produced identical rest position roentgenograms. Though neither of these patients complained of dysfunctional symptoms or pain, the findings seemed to verify Sicher's premise of spasm and, later, prompted the present study.

4. Vaughan, H. C. Temporomandibular joint pain. A new diagnostic approach. J.Pros.Den. 4:694 Sept. 1954.

5. Schwartz, L. L. Pain associated with temporomandibular joint. J.A.D.A. 51:394 Oct. 1955.

6. Sicher, H. Structural and functional basis for disorders of the temporomandibular articulation. J. Oral Surg. 13:275 Oct. 1955.

7. Hoefer, P. F. A. Electromyographic study of motor system in man. Monatschr. f. Psychiat. u. Neurol. 117:241, 1949.

8. Ryan, F., and Perry, H. Unpublished data.

THE RESTING MUSCLE

Not only are these patterns of muscle dysfunction exhibited at rest but also during masticatory function.[9] Electromyographic studies of the functioning dentition indicate that, in patient suffering occlusal or temporomandibular joint disturbances, the muscles responsible for mandibular movements are poorly coordinated and often extremely overworked. In the present study, however, although improved function in the treated patients was achieved and studied, it is not reported. The primary concern of this paper, insofar as electromyography is concerned, is the activity or lack of activity in the resting muscles.

A voluntary muscle is formed by the union of many functional parts, which are called "motor units." Each motor unit is composed of several muscle fibers and their one motor nerve. The innervation ratio of a muscle refers to the number of muscle fibers supplied by one motor nerve. The smaller ratio motor units are found in small, less powerful, quickly and precisely acting muscles, that is, digital muscles, extraocular muscles, and so forth. The larger ratio motor units are found in relatively slow powerful muscles such as the masseter, sternocleidomastoid and biceps.

When a muscle is at rest a small amount of energy is expended in maintaining a slight tension, referred to as "tonus." Tonus is like a "continual alertness" which keeps the muscle constantly prepared to act. The activity of tonus is maintained by a few widely separated and deeply located motor units. With surface electrodes this electrical activity is not recorded, because only a few motor units are randomly active in dispersed regions within the entire muscle. Therefore, a healthy resting muscle displays no evidence of innervation recordable by surface electrode and an electromyographic record from one of these resting muscles shows only a straight base line when the amplification level is set at a gain of 4 as was used in these studies.

In patients with occlusal disharmonies and temporomandibular joint dysfunctions, the absence of a true electromyographic resting pattern from the muscles of mastication has been noted. The temporal and masseter muscles, when more severe dysfunction is present, constantly exhibit a low grade electrical discharge even when the mandible is supposedly in the physiologic rest position. Certain findings with needle electrodes indicate that this is also true for the external and internal pterygoid muscles. This sustained electrical discharge and absence of rest is characteristic of muscle spasm which is due to an overactive neural discharge. The electromyographic record of this spasm-like activity is seen as minute alterations in the pen-written record of the muscle or muscles which have the spasm. It is recognized that greater gain amplification on the machine would magnify the response of the pen-writer. The particular gain of 4 was chosen for it showed spasm activity but registered a flat base line for the healthy resting muscles. It is not surprising that these individuals complain of strain and tiredness in the musculature.

In all of the patients studied electromyographically, the pattern of muscle spasm closely followed the topographic distribution of subjectively recognized pain. This finding presented a definite basis for the dull, aching type of pain which was so characteristic in these patients.

In many of the earlier patients in the clinic it was noted that with the correction of the occlusal problems and the cessation of the temporomandibular symptoms of clicking, crepitus and pain, the electromyogram of the resting muscle no longer showed the electrical evidence

9. Perry, H. T., Jr. Functional electromyography of temporal and masseter muscles in Class II, Division I malocclusion and excellent occlusion. Angle Orthodont. 25:49 Jan. 1955.

of spasm. In other words, the "resting" muscles which had previously showed a spasm activity of electrical discharge, after treatment caused no base-line deflection of the pens and resembled a healthy electromyographic pattern of resting muscle. This seemed, in itself, some basis for assuming that the pain was related directly to the dysfunction. The cause and the effect seemed present but between there must be a connecting link. This was to be found in the realms of anatomy and physiology.

In 1906 Sherrington[10] demonstrated the tactile importance of the palate, tongue and gingivae in the control and guidance of mastication. Corbin and Harrison[11] later studied the neuroanatomic basis for the reflex control of mastication. Pfaffman[12] studied the central connections and effects of pressure on the mandibular incisors of cats. To combine the investigations of these men and others and describe it in simple terms is a practical necessity if the problems of patients with occlusal and joint malfunction are to be understood.

The teeth are the principle structure, in man, for the mastication of food. They are contained in the bone of the maxilla and mandible. There is not a direct tooth-to-bone union but rather a ligament suspension of the tooth in a bony socket; this ligament is the periodontal membrane. In this space between tooth and bone occupied by the periodontal membrane are also found blood vessels, lymphatic vessels and nerve endings. It is the latter which are of primary concern.

SENSORY RECEPTORS

Sherrington[10] has classified sensory receptors into four general groups: (1) the exteroceptors are sensory organs of the skin which receive stimuli from the immediate external environment; (2) the interoceptors are those endings which transmit impulses from the visceral organs of the body; (3) teleceptors signal changes in the distant environment and are exemplified by the eyes, ears, and nose; (4) the fourth and final category concerns the sensory component of the body which gives information as to the position and movement of bodily parts in space. These endings are found in the voluntary musculature and its attached tendons as well as the labyrinthine sense organs. This fourth grouping was termed, by Sherrington, the "proprioceptive system." It is this system which is largely responsible for the smooth function of such a reflexly sustained action as walking.

Some of the minute nerve endings found in the periodontal space about the tooth fall into this proprioceptive category. Other proprioceptive nerve endings associated with mastication are found in the muscles of the temporomandibular joints and the joint itself. Thus it is seen that even as proprioception coordinates and guides walking or running, so does it for mastication.

The small sensory receptors of proprioception found about the teeth centrally direct impulses which originate from oral stimuli. These impulses travel over their special sensory nerves in the lower two divisions of the trigeminal nerve. Sensory nerves and motor nerves may travel in the same general trunk, outside the central nervous system, but along independent pathways. These sensory nerves thus send their signals to the brain over distinct pathways.

When the sensory fibers of the trigeminal nerve have reached the brain stem, there are two possible pathways which they may follow. One may lead indirectly to the thalamus and consciousness, and the other may form a reflex connection in a special nucleus of the trigeminal nerve

10. Sherrington, C. S. Integrative action of the nervous system. New Haven, Conn., Yale University Press, 1906.

11. Corbin, K. B., and Harrison, F. Functions of mesencephalic root of the fifth cranial nerve. J. Neurophysiol. 3:423 Sept. 1940.

12. Pfaffman, C. Different impulses from teeth due to pressure and noxious stimulations. J. Physiol. 97:207 1939.

in the brain stem. This nucleus, because of its anatomic position in the brain stem, is referred to as the "mesencephalic nucleus." It is to this nucleus that all of the proprioceptive nerve endings about the teeth send their sensory impulses.

Other sensory nerve endings of the trigeminal nerve concerned with pain, temperature, touch and pressure enter a distinct pathway (the spinal tract and nucleus of the trigeminal nerve) to descend and then reascend in the brain stem to the thalamus and finally conscious localization.

Both of these sensory pathways are of concern in this particular study, but for the present time only the proprioceptive component will be considered.

Corbin and Harrison,[11] in their study of the reflex control of mastication, found that it was principally the function of the mesencephalic nucleus of the trigeminal nerve. The impulses arising in the periodontal nerve endings from the stimuli of tooth contact transmit signals toward the central nervous system. Since these signals are concerned with automatic action, they need not ascend to consciousness.

Up to this point the impulses have been followed from the periodontal nerve endings into the brain stem. Since even the simplest reflex arc consists of two nerves, one sensory and one motor, a motor nerve to complete the reflex arc is still lacking.

Within the confines of the brain stem and close to the mesencephalic nucleus of the trigeminal nerve is a motor nucleus for the trigeminal nerve. The proprioceptive component (the sensory arm) makes connection with the cell bodies of the motor nerves in the motor nucleus. This initiates an efferent impulse along the motor fibers of the trigeminal nerve to the muscles of mastication.

What has been described is an extremely simplified review of the research findings of Corbin and Harrison. A logical question at this time may well be: "What does all of this have to do with the problem at hand, temporomandibular joint dysfunction?"

NEUROANATOMIC BASIS OF MANDIBULAR MOVEMENT

A study of the neuroanatomic basis of mandibular movements shows that the mandible is not entirely guided by passive tooth contact but rather dependently follows the dictates of neuromuscular function. Ill-fitting restorations, prostheses, or malpositioned teeth all act as initiators of sensory signals into a reflex system which will guide the mandible by means of its musculature, away from the areas of noxious, premature contacts. This musculature is so positioned anatomically that movements in a guiding fashion can be instituted in both the lateral or sagittal plane.

In those patients possessing only minor premature contacts or few occlusal irregularities, adjustment occurs as a normal process. When occlusal conditions present many severe functional interferences in mandibular movements, however, the inconstancy and irregularity of the stimuli accompanying function produce a continual bombardment within the mesencephalic nucleus. This constant discharge of sensory impulses is relayed to synapses in the motor nucleus with the motor cells of the trigeminal nerve. The impulses then travel peripherally in the motor nerves to the muscles responsible for mandibular guidance and posture. The various components of each muscle attempt to guide the mandible into occlusal positions of least interference. In time a position of occlusion may be found at which the protective stimuli are minimal. Then the musculature strives to relocate this position with each occluding movement. This position of least occlusal interference is found and maintained at the expense of normal muscle function.

The musculature as a result of the continual overwork and guidance becomes fatigued and metabolic products accumu-

late. With these metabolic products the sensory endings for pain in these muscles are finally stimulated and a conscious recognition of localized pain results.

Which muscles exhibit spasm in the rest position apparently is dependent on the area of the occlusal disharmony. Further study is needed before definite statements are warranted here.

In connection with this, the studies of Kellgren[13] are of interest. He injected saline solutions into various muscles and noted that when the masseter muscle was injected, it gave the sensation of toothache in the upper jaw (zygomatic region) and pain over the temporomandibular joint, whereas injections into the small suboccipital muscles resulted in headache. Lewis,[14] utilizing a similar method, noted that pain from muscle injected with hypertonic saline resembled that from ischemic muscle.

In the clinical treatment of these patients by occlusal splinting or occlusal equilibration in which interfering restoration or tooth structure is removed, the musculature is again permitted to carry out its action unhindered by excessive protective impulses. This is readily proved by the electromyographic recordings on occlusal and temporomandibular joints after correction. A few days after occlusal relief, the spasm in rest position is diminished, and in a week, if all premature contacts are relieved, the spasm and pain are gone and the rest position becomes constant.

In this study, certain of the patients complained of a dull, aching pain in the dorsum of the neck and out onto the posterior of the shoulder. It was long thought that this pain was of a referred type but electromyographic investigations of these regions indicated electrical activity at rest, not as intense in amplitude as in the masseter, temporal or pterygoid regions but, nevertheless, similar. This postcervical spasm-like activity seemed to be present in the more severe dysfunctioning instances and a flat base line of the pen-written record was not seen as was exhibited in the healthy muscle. Here again the pain and electrical activity of spasm disappeared after occlusal equilibration or occlusal splinting.

This association of the postcervical musculature with certain problems of the occlusion may seem to many rather anatomically and clinically distant. Closer consideration, however, will reveal more distant muscular cooperation and coordination in other bodily movements. Anyone who has carried a heavy piece of luggage or an instrument case any distance on one side of the body will remember how the cervical muscles, the long back muscles of the opposite side and the heavy leg muscles all contract to assist the body in balancing its new load. The head, shoulders and trunk lean to the opposite side as the body bends, by muscular contraction, about its vertebral axis to counter the weight. If the load is heavy and the distance long, even the muscles of mastication come into the act and the jaws clench tightly. All this merely emphasizes the importance of the adjustment or homeostatic qualities of the body as a whole. When an imbalance is imposed on one part of the whole, other parts attempt to assist and relieve the overworked or overstressed member.

Brodie[15] beautifully describes this concept of balance in his teachings of the balance in the musculature. His chains of muscle, beginning at the shoulder girdle, show the possibilities of direct disturbances in one group with a spread of the imbalance into other muscles in varying degrees.

In the performance of skilled movements the demands of attention and precision soon tire the few muscles carrying out the act. In the more gross, heavier

13. Kellgren, J. H. Observation on referred pains arising from muscles. Clin. Sc. 3:175, 1937.

14. Lewis, Thomas. Pain. New York, Macmillan Co., 1946, p. 40.

15. Brodie, A. G. Anatomy and physiology of head and neck musculature. Am. J. Orthodont. 36:831 Nov. 1950.

work movements, different parts of one muscle or other muscle groups will sometimes relieve or share the load with a tiring muscle and through this fatigue is postponed.

In these instances wherein the proprioceptive stimuli of a poor occlusion constantly signal the mandibular musculature to find and maintain a position of least interference there is little opportunity for division of labor. With reflex guidance of the mandible fatigue in one segment of a muscle or muscle group is soon apparent.

This resulting fatigue eventually sets up the afore-mentioned spasm activity electromyographically noted at rest. With this slight degree of muscle contraction at rest, the posture of the mandible is upset. A true physiological rest position of the mandible no longer exists. The body, however, attempts to compensate for this imbalance by calling into action its second line of muscular reserves. Just as increased load values on one side of the body results in contraction of other distant balancing muscles, so do the postural and functional disturbances of the mandibular musculature. In this action the postcervical muscles are called into play in a distant attempt to establish balance in the function of the masticatory muscles.

This assisting role by certain of the postcervical muscles may result in temporary relief to the mandibular musculature. If, however, the offending parts of the occlusion are not corrected, the mandibular musculature and postcervical musculature (or parts of each) will soon present signs of overwork, fatigue, spasm and pain.

The anatomical division of muscles into groups is necessary in teaching and understanding the function of the single unit, but the function of the whole is what the structures are there for. Histology is to anatomy as anatomy is to physiology and forever the three should be considered as one—function.

RESULTS OF TREATMENT

In 118 of the 126 patients in this study the pain was relieved by either occlusal equilibration or occlusal splinting. The remaining eight patients were relieved of some of the pain but have not, as yet, been completely relieved. In every instance wherein electromyographic evidence of spasm at rest was noted before treatment, the final electromyogram indicated a near normal or normal picture of rest—that is, an absence of electrical activity at rest.

In those eight patients in whom the treatment has failed up to the present time, the approach will continue to be that they are not neurotic but rather that the correct treatment has not yet been applied.

It is not believed that occlusal equilibration or occlusal splinting is the sole cure for all patients suffering temporomandibular joint dysfunction. There are, however, many people today who can be cured by equilibration and splinting. These methods should be tried before injection or resection are considered.

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Blueprinting Sciences • Scientific development, particularly new basic discoveries, requires complete freedom for the scientist to pursue his own curiosities. It is only for the practical application of basic principles which have already been established that science can be blueprinted. *Franz Alexander.*

Resistance of oral lactobacilli to sodium fluoride

Gordon E. Green, Ph.D., and Matthew C. Dodd, Ph.D., Columbus

The effectiveness of fluoridated water in reducing dental decay in children is generally accepted in dental health fields. The mode of action by which sodium fluoride reduces decay may be through an alteration of tooth enamel as indicated by Bibby[1] and others.[2,3] The effectiveness of sodium fluoride in low concentrations in reducing acid production by various oral organisms *in vitro* has been reported by Bibby and Van Kesteren[4] and Clapper.[5] Thus, the action of sodium fluoride also may be due to its capacity to inhibit acidogenic organisms, acid production, or both.

More recently, Gillis[6] has shown that acid production by cells of *Lactobacillus casei* pregrown in fluoride-containing media is not as readily inhibited by sodium fluoride as that of cells not pregrown in this fashion. This might indicate the acquisition of resistance to sodium fluoride or development of an alternative pathway of glycolysis by the cells pregrown in fluoride.

In view of Gillis' work and other researches in bacteriology, it might be expected that the increased use of sodium fluoride in topical dental applications, and as an additive to communal water supplies, would induce some degree of resistance to sodium fluoride in oral lactobacilli. This, in turn, might have practical importance if any significant part of the mechanism or mechanisms by which sodium fluoride inhibits tooth decay were antibacterial in nature.

MATERIALS AND METHODS

The lactobacilli used in this study were isolated from salivas of young school children in Columbus. Colony morphology was determined on tomato juice agar. Two cultures each of rough, smooth and intermediate colony morphology were selected for development of fluorine resistance. The medium used for this purpose was a modification of Rogosa's SL agar medium,[7] as follows:

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This investigation was supported in part by a grant from the Procter & Gamble Co., Cincinnati.

1. Bibby, B. G. Use of fluorine in prevention of dental caries. III. A consideration of the effectiveness of various fluoride mixtures. J.A.D.A. 34:36 Jan. 1947.

2. Scott, D. B.; Picard, R. G., and Wyckoff, R W. G. Studies of action of sodium fluoride on human enamel by electron microscopy and electron diffraction. Pub. Health Rep. 65:43 Jan. 1950.

3. Fischer, R. B.; Elsheimer, H. N., and Muhler, J: C. Effects of several fluoride reagents on the structure of whole teeth. J. D. Res. 33:538 Aug. 1954.

4. Bibby, B. G., and Van Kesteren, M. Effect of fluorine on mouth bacteria. J. D. Res. 19:391 Aug. 1940.

5. Clapper, W. E. Effect of sodium fluoride on metabolism of oral lactobacilli. Proc. Soc. Exper. Biol. & Med. 65:333 June 1947.

6. Gillis, R. E. Preliminary report on the effect of sodium fluoride on the growth and glycolysis of **Lactobacillus casei** 4646. (Abst.) J. D. Res. 33:659 Oct. 1954.

7. Rogosa, M.; Mitchell, J. A., and Wiseman, R. F. Selective medium for the isolation and enumeration of oral lactobacilli. J. D. Res. 30:682 Oct. 1951.

Trypticase, BBL	10.0 Gm.
Yeast extract, Difco	5.0 Gm.
Potassium phosphate, monobasic	6.0 Gm.
Ammonium citrate	2.0 Gm.
Sodium acetate	20.0 Gm.
Dextrose	10.0 Gm.
Sorbitan monoolcate (Tween 80)	0.75 ml.
Salt solution*	5.0 ml.
Brom cresol purple indicator, 1.6 per cent alcoholic	2.0 ml.
Distilled water	Q.S., 1 liter.

(*Salt solution composed of magnesium sulfate heptahydrate, 11.50 Gm.; manganous sulfate dihydrate, 2.40 Gm.; ferrous sulfate heptahydrate, 0.68 Gm., and distilled water, Q.S., 100 ml.)

The medium was adjusted to pH 7.0 with sodium hydroxide, and then solid sodium fluoride was added as required. The medium was then tubed and sterilized for 15 minutes at 121°C.

Estimation of acid production in this medium was visual. The parent cultures and fluorine resistant test strains were carried with 48 hour transfers, and the amount of broth culture transferred was 0.5 ml. For fermentation studies, other sugars were substituted for dextrose in this medium at 1 per cent concentration. Concentrations of sodium fluoride were measured as ppm sodium fluoride.

RESULTS AND DISCUSSION

The original level of resistance of the lactobacillus cultures was determined by inoculation into modified Rogosa's medium containing various concentrations of sodium fluoride. The six strains selected for this study had varying degrees of resistance which were representative of a large number of lactobacillus strains. Organisms from cultures containing the highest concentration of sodium fluoride in which acid production was visible were then inoculated into cultures containing higher concentrations of sodium fluoride. This starting concentration varied among the cultures. The parent strains were carried in the liquid medium without sodium fluoride as controls, and were treated in exactly the same manner as the test strains growing in the medium plus sodium fluoride. Transfers were made every 48 hours at given levels of sodium fluoride until the amount of 48 hour growth was judged sufficient to allow transfer to a higher concentration. The stepwise increase in sodium fluoride concentrations in the medium was at 500 ppm levels. Each time a resistant test strain was transferred to a higher level of sodium fluoride concentration, both it and the control parent strain were plated on tomato juice agar at pH 5 and pH 7 to observe colony morphology.

The table shows the effect of acquired sodium fluoride resistance on colony morphology and the concentrations to which resistance was developed. Changes in colony morphology were not consistent, and it does not appear that the presence of sodium fluoride favors the expression of any one colony type. At the final concentrations shown, the resistant cultures were growing very poorly in the sodium fluoride medium, and only three were still visibly producing acid. Considering the nature of the biological action of sodium fluoride, it was surprising to find such high initial tolerance (3,000 to 7,000 ppm sodium fluoride) in the strains examined, and that they could acquire the ability to grow and produce acid in the presence of approximately 2 per cent sodium fluoride.

Microscopic examination of gram stained 24 hour broth cultures showed that the resistant cells were somewhat longer than the parent strains, and had a tendency to granulation. No other difference was seen.

At the conclusion of this experiment the parent control strains were inoculated in media containing various concentra-

Table • Changes in lactobacillus colony morphology with resistance to sodium fluoride

Culture	Original morphology	Concentration in thousands of ppm sodium fluoride				Final morphology		Final morphology of control parent strain	
		Original conc.	Final conc.	Conc. where morphology changed					
				pH5*	pH7	pH5	pH7	pH5	pH7
F1	Smooth	5	22	5.5	5.5	Rough	Rough	Smooth	Smooth
F6	Intermediate	6	21.5†	—	—	Inter.	Inter.	Inter.	Inter.
F7	Smooth	3	21	4	4.5	Inter.	Inter.	Smooth	Inter.
F11	Rough	7	22.5†	16	—	No growth	Rough	Rough	Rough
F14	Intermediate	5	19	—	—	Inter.	Inter.	Inter.	Inter.
F19	Rough	6	17.5†	7.5	10	Smooth Dew drop	Smooth Dew drop	Rough	Rough

*Observed on tomato juice, agar at pH5 and pH7.
†Acid production no longer evident.

tions of sodium fluoride to verify that their original resistance had not been altered by the series of 48 hour transfers carried out over the year.

Comparisons of fermentations of the resistant and parent control strains were made using Rogosa's SL medium (modified) plus dextrose, sucrose, mannitol, raffinose, rhamnose, or sorbitol, and litmus milk. No differences were seen.

From these data it seems unlikely that the concentrations of sodium fluoride with which an individual might come in contact are sufficient to induce considerable changes in acidogenic capacity or growth potential of oral lactobacilli. It is possible that such concentrations might reduce the cariogenic potential of oral lactobacilli to some extent by even a slight reduction in acidogenic capacities.

SUMMARY

Examination of a number of strains of oral lactobacilli revealed initial tolerances to concentrations of sodium fluoride ranging from 0 to 10,000 ppm sodium fluoride. The development of resistance to sodium fluoride was accompanied by some changes in colony and cellular morphology, but no apparent change in several fermentative characteristics. Several sodium fluoride-resistant strains were capable of producing acid from glucose in a medium containing about 2 per cent sodium fluoride.

Morality and the Ages • The man in an airplane is not necessarily less devoted to truth, justice, and charity than his forefathers traveling in oxcarts. Virtue does not necessarily go with primitive plumbing, and human dignity can be nurtured in a skyscraper no less than in a log cabin. ***David Sarnoff.***

Reattachment operation: a conservative procedure for elimination of periodontal pockets

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The reattachment operation is a surgical procedure for the elimination of periodontal pockets, a partial description of which has appeared in a previous paper.[1] After the successful reattachment operation, new connective tissue, new bone, new cementum and epithelium at a more coronal level may be obtained. It is therefore conservative in nature, even though surgical. The so-called conservative technics of periodontal therapy, which are directed only toward calculus removal and which are not directed toward pocket elimination, often fail to prevent further supporting tissue destruction. There have been occasional instances of reattachment and bone regeneration, however, after what has been described as simple calculus removal.[2-4] These will be discussed later in the paper.

By reattachment is meant a new connection between the tissues around the tooth and the root at a more coronal level, where formerly a space or pathologic pocket existed associated with periodontal disease. The term is not used to imply a reattachment which occurs after surgical detachment, as in a flap procedure.

The operation can be performed by the general practitioner, and the results of the operation will depend partly on the operator, as will be outlined. It is a simple, painless procedure accomplished in one sitting on one quadrant of the mouth under local anesthesia. It includes the removal of calculus at the same sitting. It is recommended that no calculus be removed prior to the reattachment operation.

RATIONALE

It is important to understand the histopathologic findings in a deep periodontal pocket. Figure 1 illustrates such a pocket with calculus and a keratinous layer on the root surface, epithelium in varying amounts extending to the attachment area and below, chronic inflammatory tissue consisting primarily of plasma cells and other inflammatory cells, with a reduced number of collagenous fibers. There is active bone resorption. Blood vessels are close to the surface and frequently there is a purulent exudate. Blood vessels associated with the inflammatory change will be enlarged; also the epithelium is better defined as the gingival margin is approached.

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1. Shapiro, Max. Reattachment in periodontal disease. J. Periodont. 24:26 Jan. 1953.

2. Marshall, John S. A remarkable case of pyorrhoea alveolaris with reproduction of bone occurring in the practice of Dr. Allport. J.A.M.A. 1:641 Dec. 8, 1893.

3. Younger, W. J. Some of the latest phases in implantation and other operations. D. Cosmos 35:102 Feb. 1893.

4. Barkann, Lillian, Conservative surgical technic for the eradication of a pyorrhea pocket. J.A.D.A. 26:61 Jan. 1939.

Fig. 1 • Periodontal pocket

It is important also to know the healing mechanisms of the various tissues. This knowledge will help in understanding the rationale of the technic described, and enable the operator to alter the technic to suit a peculiar and different situation.

Connective tissue heals through organization of the blood clot, with the formation of fibroblasts, cementoblasts and osteoblasts from the undifferentiated mesenchymal cells.[5,6] The epithelium heals by proliferation of cells from the stratum germinativum in a lateral direction, and passes over the organizing connective tissue, and under the necrotic portion of the blood clot. It continues to proliferate, covering the healing wound surface and passing apically until it reaches the junction of the tooth and the first connective tissue fiber which is attached to the tooth. To summarize the healing mechanism then, the connective tissue reforms while the epithelium is migrating over the organizing connective tissue elements.

If reattachment is to occur, the connective tissue will have regenerated at a more coronal level than previously found, and the epithelium will be stopped in its apical migration by the newly formed connective tissue fibers embedded in the new cementum or cementoid on the one side, and either new bone or free gingiva at its other aspect.

DIAGNOSIS AND EVALUATION

At the diagnostic visits, roentgenograms, alginate impressions and Kodachrome photographs are taken. Complete records are made of pocket depths around all the teeth. In addition to this, records are made of gingival color, surface and tone; condition of marginal regions; occlusal trauma; impaction of food; mobility; vitality; roentgenographic condition; and miscellaneous conditions. Prognosis and recommendation are recorded on a tooth to tooth basis.

Also prior to the reattachment operation, the patient is evaluated as completely as possible for systemic as well as local etiologic factors. A series of tests are made by the patient's physician or at a laboratory to determine the following: blood iodine, or basal metabolic rate; complete blood count; blood sugar; bleeding and clotting time; serum cholesterol; serum calcium; serum phosphorus and urinalysis. In connection with the reattachment operation, these tests (1) determine whether alterations in therapy are necessary; (2) serve as an index of healing potential, the thought being that a patient whose condition is determined to be well balanced by these

5. Maximow, A. A. Morphology of mesenchymal reactions. Arch. Path. & Lab. Med. 4:557 Oct. 1927.

6. Archer, E., and Orban, B. Dynamics of wound healing following elimination of gingival pockets. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 31:40 Jan. 1945.

various laboratory procedures may be more desirable from a standpoint of prognosis than one showing noticeable degrees of abnormality, even though not clinically ill.

The treatment plan is completely outlined at the diagnostic visits, with recommendations. No re-evaluation is necessary when a complete diagnosis is made at the beginning of treatment. Changes in treatment planning are an indication of failure in diagnosis.

After a complete evaluation of the patient as regards local and systemic factors, gross equilibration is done. This may require one or more sittings.

REATTACHMENT OPERATION

The reattachment operation is performed after elimination of as many actual or potential local and systemic etiologic factors as possible. Local anesthesia is used with infiltration for the maxilla and block anesthesia for the mandible. One quadrant is operated on at a time. Hoes, scalers, curets and files are used and the root surfaces of the teeth to the bottom of the formerly charted pockets are freed of calculus. Fine sharp explorers are used to examine root surfaces.

A knife, preferably one with a thin, pointed blade, is used to remove at an angle 2 to 3 mm. of gingival tissue so that a bevel is created (Fig. 2, above). The object of this incision is (1) to increase the distance of the epithelial edge from the healing wound, (2) to remove the epithelial tissues in the vicinity of the healing wound, and (3) to create a more ideal gingival form where indicated.

Curets such as the Younger-Good type are used to curet the soft tissue wall of the pocket completely around each tooth to a depth which varies with the pocket (Fig. 2, left), and until resistance is felt. The object of this is to remove the epithelium as completely as possible. It will be noted that occasionally granulation tissue will be removed as well. The curets are used as scalers with a push

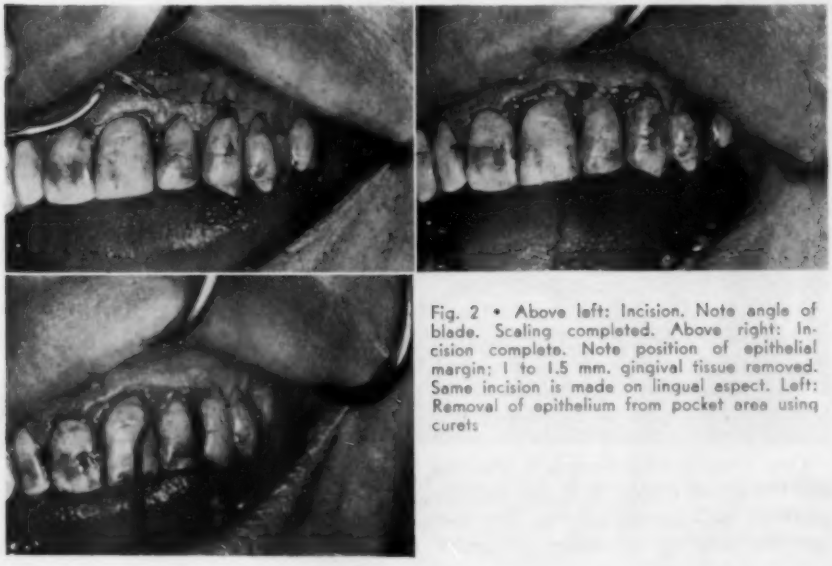

Fig. 2 • Above left: Incision. Note angle of blade. Scaling completed. Above right: Incision complete. Note position of epithelial margin; 1 to 1.5 mm. gingival tissue removed. Same incision is made on lingual aspect. Left: Removal of epithelium from pocket area using curets

motion to remove calculus in the deep portions of the pocket. The region is again examined carefully for the removal of calculus which completes the reattachment operation.

A blood clot is permitted to form. Previous bleeding and clotting studies will indicate the time necessary for clot formation to take place, or whether difficulty will be experienced here. In order to prevent pain and protect the wound surface and blood clot, a soft pack, similar to Box's periodontal pack, is applied in a continuous roll, starting at one end of the operated region and pressing gently against the teeth until the quadrant is completely covered on the buccal and lingual surfaces (Fig. 3).

The periodontal pack consists of the following: zinc oxide, C.P., 45 Gm.; powdered rosin, white, 40 Gm.; tannic acid, 10 Gm.; kaolin, 2.5, asbestos, shredded grade no. 7, 7.5, together with eugenol, 98.0 cc., thymol, 2.0, and red color, as needed.

Simultaneous slight pressure on buccal and lingual portions of the pack will engage the pack in the interproximal region. The pack is an extremely slow setting type and can be mixed several hours before the surgical procedures. It will set in the mouth in about 30 minutes. No attempt is made to dry the field, and no medications or other materials are used.

The following instructions are given to the patient: the pack should not be removed, should not be touched the first day, but the region may be brushed after the first day; mouth rinses should not be used the first day, but may be used once or twice a day thereafter. If any pain is experienced, the office should be called, as such pain is due to dislodging of the pack or impingement of the pack on soft tissues.

One week later the pack is removed and the region flushed with any suitable, pleasant tasting mouth rinse. The postoperative healing is usually uneventful. The patient usually experiences no pain or discomfort after the procedure, and as a rule there is no swelling. A new pack is placed as before. The placement of the pack causes a slight burning or tingling sensation for three to five minutes, after which there is complete comfort. The pack is allowed to remain seven more days and then removed. At this time brushing instruction is given. The technic used by the author is the modified Charter's method, with the extra hard, two-row brush. There is complete epithelization at this time, and there is no discomfort when the Charter's technic is used. When properly and diligently used, the toothbrush alone is capable of doing everything necessary to maintain gingival health. The use of other devices such as various interdental stimulators is usually unnecessary, and complicates the patient's oral hygiene procedures.

After the four quadrants of the mouth have been operated on and the last pack removed, the patient is given a prophylaxis; then, the operated regions are observed carefully for evidence of improper home care. The patient is seen once or twice a week, and each interproximal tooth surface is examined for the presence of food and bacterial debris, usually white in color. If any such deposits are present, the patient is informed and instructed in the care of these regions. This is repeated as long as necessary and may occupy many weeks.

EVALUATION OF RESULTS

In periodontal therapy, it is important that the operator understand and know his results. Unless pocket depths are recorded carefully, it becomes difficult to evaluate (1) the final outcome of the treatment, or (2) how much has been accomplished (Fig. 4).

Results are based on accurate clinical measurements which involve the initial complete charting of the patient's mouth, the postoperative charting of the patient's

Fig. 3 • Left: Pack in position on labial aspect. Right: On lingual aspect

mouth, and measurements taken on good study casts. The measurement technic best suited is the two step one which has been described.[1] This enables the operator to determine the changes in the bottom of the pocket as well as the changes in the gingival margins. In addition, comparison of before and after Kodachrome pictures is helpful. Good roentgenograms taken at uniform intervals and with standardized technic are compared. Inasmuch as reattachment means new connective tissue and new bone formation, the new bone should be visible on the roentgenogram. The before and after roentgenograms should be as similar as possible with respect to angle and density; only then can valid comparisons be made.

That new bone formation can occur in root areas previously denuded is well established in endodontics.[5] Large areas of bone have formed around formerly denuded root tips after certain endodontic procedures.

Reattachment can be evaluated clinically in two ways: (1) by changes in pocket measurement, as measured from a fixed point on a tooth to the gingival margin and to the bottom of the pocket, thus giving the operator a knowledge of exactly what happened to the tissue, how much recession and attachment occurred, and (2) by changes in the roentgenogram indicating new bone formation or increased bone density (Fig. 5).

The percentage of success after the reattachment operation may be fairly high, but will vary. Failures which do occur may be the result of neglect or disregard of one of the several phases: incomplete

Fig. 4 • Left: Six weeks' postoperative condition, 2.5 mm. Right: Measurement from exit point of probe. Incisal edge—10 mm. Bottom of pocket, 12.5 mm. to incisal edge (recession 1 mm., reattachment, 4 mm.) (Measurements before treatment: 7.5 mm. to incisal edge from exit point; 16.5 mm. to incisal edge)

Fig. 5 • Above left: Girl, age 15. Before operation. Pocket 11 mm. on labial aspect and in lower left central region. Above right: Postoperative view. Crevice 1.5 mm.; recession 1.5 mm.; reattachment 8 mm. Center left: Woman, age 28. Clinical measurements show original pocket 9 mm. deep. Center right: One year after reattachment operation, measurement showed reattachment 4 mm.; recession 2 mm. Below left: Woman, age 45. Mobility of several years' duration; no acute symptoms. Below right: One and a half years' postoperatively; no mobility. Reattachment, 6 to 7 mm.; recession 1 to 2 mm.

calculus removal, inadequate removal of epithelium, or lack of tissue-building capacity of the patient. Of 20 patients sampled, out of 200 treated as described, approximately 70 per cent of the deepest pockets showed significant reattachment as evidenced by clinical measurement.[1]

DISCUSSION

The objection is made frequently that patients evidencing reattachment cannot be examined histologically. Becks and Grimm[7] in 1945 and Massler[8] in 1954 pointed out that histologic findings were correlated with roentgenographic observations. Roentgenographic changes were mirrored in histologic changes. Moreover, Schaffer and Zander[9] and Ramfjord,[10] in their reattachment studies, found that when clinical measurements indicated a crownward movement of the bottom of the pocket, histologic examination revealed the same findings. The roentgenogram is the practitioner's microscope. It is understood, however, that not all regions are subject to a roentgenographic examination. Changes in bone are difficult or impossible to show on the roentgenogram, for example, in the labial, buccal, or lingual aspects.

It will be noted that the initial incision which is made as part of the reattachment operation for one or more teeth will eradicate completely a shallow pocket on an adjacent tooth, and will also result in a more favorably contoured gingiva if the tissue is enlarged. This procedure, then, can be used on a quadrant of the mouth or more, eliminating pockets by recession or reattachment, depending on the pocket depth, and contouring the tissue where desirable.

7. Becks, H., and Grimm, D. H. Comparative roentgenographic and histologic study of human mandibles. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 31:383 July 1945.

8. Massler, M. Changes in lamina dura during tooth movement. Am. J. Orthodont. 40:364 May 1954.

9. Schaffer, E., and Zander, H. Histological evidence of reattachment of periodontal pockets. Paradent. 7:101 Oct. 1953.

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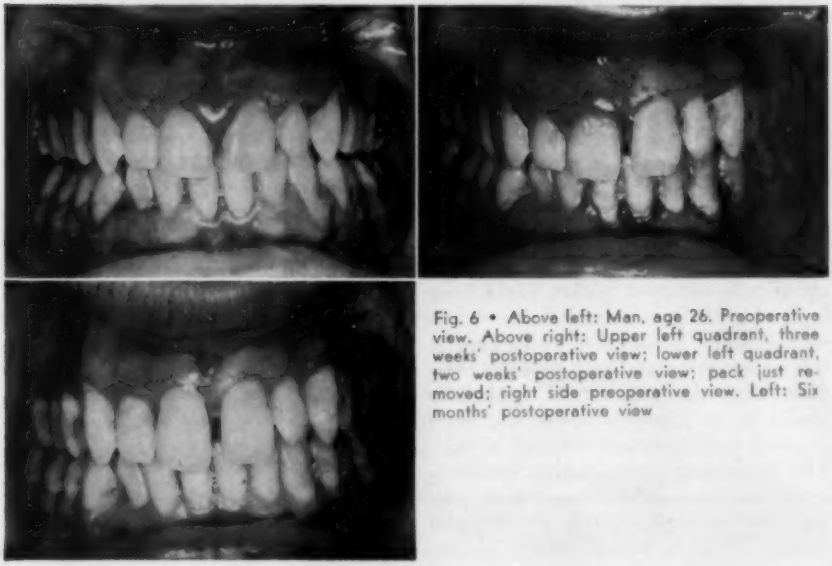

Fig. 6 • Above left: Man, age 26. Preoperative view. Above right: Upper left quadrant, three weeks' postoperative view; lower left quadrant, two weeks' postoperative view; pack just removed; right side preoperative view. Left: Six months' postoperative view

Fig. 7 • Woman, age 38. Lower left quadrant, preoperative view; lower right quadrant, three weeks after reattachment operation

It will be noted, too, that no prior sittings are set aside for scaling. The removal of calculus is accomplished at the same sitting as the other operative procedures. In operating on 700 patients this way, and comparing the postoperative results with instances where scaling was done prior to surgical intervention, no differences were noted in the rate of healing (Fig. 6, 7), there was no granulation tissue other than that encountered when a pack became dislodged, and the bleeding appeared quantitatively the same. The immediate postoperative results with the patient were the same.

It may be that performing the surgical operation in an inflamed field is desirable and may result in greater success. It is well known that acute periodontal abscesses heal readily, and in many instances reattachment of the membrane and new bone growth occur. The chronically inflamed pocket has a poor layer of epithelium lining it, with regions of ulceration. Removal of epithelium in this state is easier and perhaps more complete than the removal of epithelium would be in a pocket which had been curetted previously and allowed to heal. The immediate postoperative condition would be more acute without prior scaling. The histologic study of a pocket also reveals enlarged blood vessels in the region of the pocket. This increased blood supply to the area of the healing wound in unscaled pockets may be desirable. It may also be an aid in the reattachment process.

It may be possible that scaling as generally done at sittings prior to the reattachment attempt may not only be more difficult, more time consuming, and more painful, but may also reduce the incidence of success. More study is needed in this direction.

The instances of reattachment noted by many[2-4] who only scaled the teeth in regions of deep pockets probably resulted from meticulous care. In an effort to smooth the root surface carefully and completely, the pocket epithelium was removed as has been shown by Ramfjord,[11] the root surface properly freed of calculus and debris, and thus some of the necessary requisites were established to secure a successful reattachment. The mechanism, however, was not understood for some time, and the results therefore, were not predictable.

No reference has been made to indications. The procedure described is suitable in any deep periodontal pocket. It is felt that the only criteria necessary are (1) that the pocket be deep, (2) that the remaining tissues be firm, and (3) that the etiologic factors will have been eliminated as much as possible. New tissue growth, with reattachment, has been observed in regions where only soft gingival tissue was present, and even where no soft or hard tissue was present (Fig. 8). It may be that in the latter instance the blood clot on the surface of the healing wound and root, not being displaced by the soft pack, organized quickly enough to form new tissue, so that the gingival tissues were higher than before and in a region where no tissue had existed before.

11. Ramfjord, S., and Kiester, G. Gingival sulcus and the periodontal pocket immediately following scaling of teeth. J. Periodont. 25:167 July 1954.

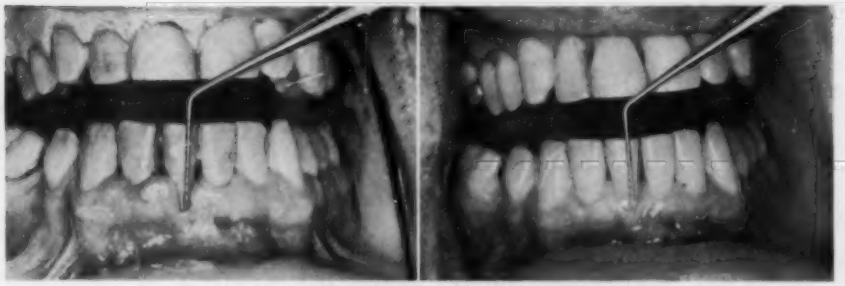

Fig. 8 • Left: Man, age 32. Preoperative view; 10+ mm. from gingival margin to incisal edge (pocket 3 mm.). Right: One year after reattachment operation; 9 mm. from gingival margin to incisal edge (0.5 mm. crevice)

Future efforts in the field of reattachment should be directed toward (1) increasing or speeding connective tissue growth, (2) decreasing the time of epithelial regeneration, (3) changing instrument design and technic to carry out necessary phases more completely, and (4) introducing systemically acting drugs, hormones, or other substances to create a more favorable response. The author is engaged in investigating several of these phases, and the results will be reported at a later date.

SUMMARY

A technic has been developed for a reattachment operation which is a simple, painless, one-sitting procedure. It combines scaling, curettage, gingivectomy or gingivoplasty to eradicate pockets.

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Books as Friends • There is no pleasure so rewarding as having for life-long friends a few selected writers who with their inspired ideas, their crystal-like prose, the idealism of their lives and the lyrical essence of their work enliven with enchanting colors the gray monotony of our daily lives. ***Félix Martí-Ibáñez, Books in the Physician's Life.***

The dental program at the United Cerebral Palsy Diagnostic and Treatment Center, Roosevelt, N. Y.

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"Cerebral palsy," states Dr. Winthrop M. Phelps of Maryland, a recognized authority in this field, "is not a single entity; it represents several conditions grouped together because they are caused by injury to, or disease of, some part of the brain." The injury may be caused by difficult birth after infectious diseases such as measles, whooping cough, meningitis or encephalitis. The Rh factor has also been suggested as a causative agent. The resultant condition is a group of pathologic states where muscular control is lost, or impaired to varying degrees.

The most commonly involved regions of the brain, either singly or in combination, are the motor cortex, basal ganglia and cerebellum, ventral horn of the spinal cord and, less frequently, the sensory portion of the brain and cord. These involvements cause the five generally recognized types of cerebral palsy; spasticity, athetosis, ataxia, rigidity and tremors, in the order of their frequency.

Spasticity is believed to be due to injury to the motor cortex or pyramidal tracts of the brain. This results in a partially or completely diminished ability to control muscular movements. There is usually extreme muscular stiffness apparent when the patient attempts movement of arms or legs. When sitting still, this stiffness tends to disappear, thus making him a not too difficult dental patient. This group comprises about 45 to 50 per cent of all cases.

Athetosis results from injury to or defects in the brain's basal ganglia or extrapyramidal tract. There is a general lack of voluntary muscle control which results in constant involuntary muscular movement such as facial grimaces, drooling, or speech defects, and these may leave a false impression of mental defectiveness. These children make poor dental patients and comprise about 35 per cent of all instances.

Ataxia is due to lesions or defects in the cerebellum. Sensation is particularly involved. The chief problem here is a severe disturbance of the equilibrium. There is almost constant motion of the eyes, and this causes dizziness and nausea. Sitting erect is almost impossible, making this individual a poor dental patient. This group comprises about 15 per cent.

Rigidity, a form present in about 10 per cent of all patients with cerebral palsy, is characterized by muscular resistance and is related to spasticity. Mental damage is associated with this group

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to a greater degree than with any of the others.

Tremors resemble athetosis in their effect on muscular control. There is no mental damage in these instances, and they comprise about 5 to 10 per cent of all cases.

Naturally, all of these people have mouths and teeth, and they require dental services the same as any group of people except that, because of their disabilities, they are a special problem. Actually many of these children are in a deplorable dental condition at an early age. They not only suffer more dental neglect than average patients, but also suffer the consequences to a greater degree. Their functional limitations often dictate a type of diet lacking the essentials for a good dentition. Poor mastication also limits their diet to soft foods mainly composed of carbohydrates. There is usually insufficient proteins and minerals to produce proper balance. In addition, the child's oral structures are generally poor — malocclusion, unhealthy periodontal tissues and poor oral hygiene are characteristic of many of the cerebral palsied.

Because so little was known about these individuals, they were much misunderstood for a long time. Most of their dental treatment had been in the nature of emergency extractions where the teeth had decayed beyond repair. Conscientious dentists had attempted to treat them in their offices with varying degrees of success, but the children were a great problem because of their disabilities, and it took much time, patience and perseverance to accomplish any work for them.

They were also an emotional problem. Often the visit to the dentist was their first experience with the outside world, except perhaps for visits from their physician. The patient's behavior pattern varied, depending on the education he had received from the person who usually accompanied him.

These were some of the problems facing the dentists of Nassau County when the dental society was invited to participate in the cerebral palsy program in the county.

TREATMENT CENTER

The United Cerebral Palsy Diagnostic and Treatment Center at Roosevelt, Long Island, N. Y., was planned as a pioneering approach to the treatment and rehabilitation of the palsied.

When this Center was planned, the proposal was made to include dental treatment on an organized and integrated basis. This was to be accomplished on a three-point plan: (1) it would be channeled through organized dentistry; (2) it would have the best equipment, and (3) there would be a private practice approach to the patient.

The dentists responded admirably to the call for volunteers to donate their time to the clinic. A training program was also set up for women who volunteered to assist the dentists.

The Center is not a home. (Heretofore the palsied child was treated in a children's hospital or home, or in a group with other handicapped children.) All children live at home with their families and are brought daily to the Center for the various activities.

This Center, planned and built to treat only the palsied child on a complete and integrated basis, is composed of the following departments: medical (diagnostic and treatment), dental, psychology, hearing, speech, social service, brace, podiatry, occupational therapy, physical therapy, pre-school, school, sheltered workshop and vocational guidance, summer day camp program and adult recreation.

The dental clinic has been functioning more than three years and has accomplished much in the way of gaining the confidence of the children at this Center, thereby helping the dentist to rehabilitate their mouths. The dentists on the staff

have derived a great personal satisfaction, both from a sense of accomplishment in handling these children, and from performing a community service.

In order to integrate the dental program with all the other phases of treatment at the Center in an effort to rehabilitate the palsied child and help him find his place as a useful member of society, the dentists have tried to perform the very best in dentistry for three important reasons:

1. Because of his involuntary motions and tensions, the palsied child uses up large amounts of energy and in order to maintain these high energy requirements, he must be able to chew his food well. Good teeth, in proper position, are essential for good chewing and are thereby an aid to good digestion.

2. Because proper speech is such a major problem among many of these children, teeth in poor position, or poorly formed or missing because of early extraction, can further impede it. Therefore, good mouth care is most important as an aid to this form of communication.

3. Because good appearance is of extreme importance, especially to the physically handicapped, since it affects the prospects of employment and of getting along with people and thereby affects the personality of an individual, the dentist plays a most important part by improving appearance through the maintenance of good teeth.

The children are treated as private patients in a normal, routine procedure, and the same dentist sees the same children until all of their work is completed. They are then put on a regular recall basis for check-ups. If any problems arise, consultations are held with people who are specialists in their field as to the best procedure in the treatment of that particular case. The attending dentists have consultants in oral surgery, orthodontics and periodontics, and are in constant touch with the pediatricians on the Center staff.

The children have responded remarkably well to this procedure, and there is no difficulty in getting them to keep their appointments. It is heartwarming to walk into a classroom or workshop and have them wave "hello" or make some flippant comment, or even come over to show how well they are taking care of their teeth. This is the best proof that they consider dentists their friends.

There has been but one real problem and that is a small group of children who require a considerable amount of dental work, and who are unable to accept treatment by routine methods because of either their extreme youth or an almost complete inability to control even partially their involuntary movements, or any combination of behavior problems and fears that many children exhibit. The only way to treat this group is to do their dental work under general anesthesia where complete relaxation can be obtained.

This approach to the dental treatment of difficult and handicapped children, although not really new, is becoming more widely known and accepted. It is

an outgrowth of the efforts of many conscientious dentists to do a complete dental rehabilitation for children who have been unable to be treated routinely. After a thorough medical work-up by the pediatrician, the child is completely anesthetized and all the dental work, such as fillings, pulpotomies and extractions, is accomplished at one time.

This type of service has been rendered in dental offices for over ten years for the physically and mentally handicapped and otherwise difficult children with gratifying results. However, because the highly specialized nature of dental treatment for cerebral palsied children makes it a financial burden to many parents, arrangements were made with the County Hospital to use their anesthesia facilities and have clinic staff dentists perform the needed dental work at the hospital for those patients who could not be treated in a routine manner.

For those who prefer private care for their children, office treatment is given. After a preliminary examination of the child and consultation with the parents, a complete blood count and urinalysis is ordered and a preanesthetic evaluation is made by the child's physician the day before. The child is premedicated at home with a combination of sodium pentobarbital, meperidine and scopolamine administered rectally one hour before the appointment. Of course, he has had absolutely nothing by mouth that morning.

The child is placed on the operating table in the supine position and anesthesia is induced with nitrous oxide-oxygen (80-20) by use of a face mask and, as soon as early third stage anesthesia is obtained, the mixture is supplemented with trichloroethylene. The rebreathing apparatus is completely shut off, and the exhaling valve of the mask adjusted without tension. This tends to blow off nitrogen from the mixture and also keeps the concentration of carbon dioxide at a minimum.

A venipuncture is then made at a suitable site, usually in the ankle with the younger children, and a 5 per cent dextrose drip is started. Meperidine, in a concentration of 5 mg. per cubic centimeter, is injected intravenously through the drip tube, and the respiratory rate is checked until it drops to 12 to 15 per minute. The mouth is opened and the throat inspected with the aid of a laryngoscope.

The nose and larynx is sprayed with a cocaine solution, the vocal chords are visualized and, if relaxed sufficiently, an endotracheal tube is passed through the nose, past the chords into the trachea. If necessary, succinyl choline chloride is injected intravenously to obtain greater relaxation to facilitate the passage of the catheter. A Stevens-Slater valve and bag are connected to the endotracheal tube and anesthesia is maintained by this means with a 70-30 mixture of nitrous oxide-oxygen and trichloroethylene. From time to time additional amounts of meperidine are injected through the drip tube to keep the child in a level plane, as evidenced by the respiratory rate.

When the child is to be treated at the County Hospital, he is admitted at 9:00 A.M. and goes through the regular preoperative routine. He is premedicated by the anesthesiologist with essentially the same drugs as are used in the office, starting at about 10:00 A.M., and is scheduled for the operating room at 1:00 P.M.

By the time the child is wheeled into the operating room, he is generally very well sedated and anesthesia is induced with ether supplemented with intravenous thiopental sodium. He is then given some succinyl choline chloride intravenously, an endotracheal tube is inserted, and he is carried on nitrous-oxide oxygen and the intravenous thiopental sodium for the entire time of the operation.

The mouth is opened, a rubber prop placed between the posterior teeth on one side and the throat packed to prevent debris from getting down around the tube. The operative dentistry is then begun and completed quadrant by quadrant, leaving any surgical procedures for the end.

In dental offices, the children are treated on an ambulatory basis. Sedation is kept to a minimum; usually the child is reacting well within five to ten minutes after the cessation of anesthesia and can be taken home within half an hour. At the hospital the child is more deeply sedated and more deeply anesthetized, the ether being eliminated much more slowly. As a result he usually is not ready to go home that day and must spend the night at the hospital.

Other institutions dealing with cerebral palsy have reported that as high as 20 per cent of their patients require general anesthesia. Dentists at the Center have found this percentage to be as low as 4 or 5 per cent of the total number of patients. The author recently rechecked a group of 20 children awaiting general anesthesia and recommended that routine care with some modifications be tried with 14, leaving only six for general anesthesia.

These modifications generally start with changing the dentist as often there may be a personality clash. Lately clinic dentists have been using sedation for the extremely apprehensive as experience shows most of these children can be handled without resorting to general anesthesia. Complete cooperation of the Center pediatric service has been given in this work, despite the fact that sedation was generally frowned upon by other workers in the field who were of the opinion that it was useless, in view of the fact that the metabolic rate of these children was so high. Meperidine has been used with gratifying results, and plans are to use a secobarbital, meperidine and scopolamine mixture in the near future.

Dental service, of course, starts with an examination. It is here that the child and dentist first meet and where much of the child's behavior pattern will become evident. There is need for the utmost patience on the dentist's part, because this is a time-consuming process. With spastics, mouth props should be used to spare the dentist's fingers; the dentist must always be on the alert to prevent injury to himself and the patient.

Constant drooling is a great problem, and the use of atropine or its derivatives to help control it is contemplated. Roentgenographic examinations are also extremely difficult in a great many of the palsied. With constant movement of the head and jaws, drooling and gagging, it is almost impossible to get a good diagnostic film. A change over to ultra-fast films has been made in the hope of getting better results.

One of the chief problems is achieving a good cavity preparation with all of the decay removed and a cement base placed prior to final filling. In many instances, it is almost impossible to accomplish all that could be wished along those lines. Sometimes silver nitrate is resorted to when it is impossible to determine if all the caries has been removed. The tooth is then filled with silver alloy or silicate.

Extractions generally have been no problem and are performed routinely with the use of local anesthesia. When the mouth is in a bad condition and multiple extractions are required and the child is uncooperative, the patient

has been referred to the County Hospital for the surgery. When the parents refuse to use the hospital facilities, referral is made to one of the oral surgeons on the clinic staff.

A big problem is the periodontal condition of many of these children. Whether this is caused solely by the inability of the children to brush their teeth or results from the trauma caused by extreme grinding and abrasion is not yet known. One of the staff members, interested in the periodontal problem, has been given a free hand to see what he can find out and accomplish.

Among the volunteer chair assistants are several former dental hygienists who have begun giving prophylaxes to those children whom they were able to handle, thus relieving the dentists of some of the burden of dental care. The children are recalled regularly for check-up and prophylaxis.

Since the dentists have not been called on to do any prosthetic work, there has been no experience along these lines. This problem will have to be worked out as the occasion arises. It would seem that the problems should be neither more nor less than with the operative work for these patients. If they can cooperate sufficiently for proper preparations and impressions, there will be no problem.

In the orthodontic field, there is at present one young lady who has been wearing an appliance for several years. Attended by the clinic orthodontic consultant, her treatment is financed through state aid. There are several others who may require some form of orthodontic service who are being observed regularly until such time as they are old enough, or the dental staff is certain they will require correction.

DENTAL STAFF

The dental clinic began operating in November 1953, with a flexible staff of 30 to 40 dentists who had shown an interest in the newly-proposed service, and who had attended several conferences. Since most of the dentists knew nothing about the handling of cerebral palsied children, it was decided to have two on service at a time so they could assist each other with the actual physical aspect of controlling the patients.

Having read and heard of restraining devices being used in various clinics throughout the country, the volunteers were somewhat awed by the attempt to treat these children with no more than two pairs of hands and open minds. To date, no restraining device of any kind has been used and, as a matter of fact, straps attached to the chair ordered for use in the clinic were removed.

It was discovered early that: (1) only one dentist at a time was needed; (2) the dentist had only to tip the chair back to give the patient a feeling of not falling forward and out of the chair; and (3) plenty of tender loving care was necessary.

By the end of 1954, the number of dentists remaining on the staff had pretty well stabilized, a new director was appointed, and the dental service was reorganized. There were two services of five months each; the dental clinic closed during the summer.

The clinic is open every morning five days a week from 9:00 A.M. to noon, and each dentist attends the same morning every other week. In this way, each man can see the same patients regularly, and at the same time he is not kept too long from his private practice. The patients are scheduled every half hour and, depending on conditions, an average of four to six are seen each morning.

In 1954 there were 481 children seen in the Center, and in 1955 the number had increased to 672 for all services. Of course, all of these children do not come to the dental service. There are actually 236 patients in the dental files.

In 1954, and including November and December of 1953 when the dental serv-

ice commenced, there were 576 dental clinic visits, with the following breakdown of the services performed:

Examinations	130
Prophylaxes	106
Premedication	6
Fillings	431
a. Class 1	266
b. Class 2	104
c. Class 3	21
d. Class 5	40
Local anesthesia	70
Roentgenograms	85
Zinc oxide and eugenol tooth treatments	36
Extractions	32
Recalls	16

In 1955 there were 772 clinic visits, with the following breakdown:

Examinations	74
Prophylaxes	103
Premedication	40
Fillings	319
a. Class 1	188
b. Class 2	86
c. Class 3	17
d. Class 4	1
e. Class 5	27
Local anesthesia	68
Roentgenograms	69
Zinc oxide and eugenol tooth treatments	30
Extractions	27
Periodontal treatments	10
Recalls	21

In 1956 there were 609 active patients at the Center for all services. Of these, for 200 half days in the dental clinic, there were 692 dental visits with the following breakdown:

Examinations	87
Prophylaxes	127
Periodontal treatment	3
Premedication	31
Fillings	412
Class 1	226
Class 2	98
Class 3	23
Class 4	15
Class 5	50
Anesthesia (local)	70
Anesthesia (general)	13
Roentgenograms	85
Recalls	42
Zinc oxide-eugenol treatments	40
Extractions	32
Root canal therapy	1
Orthodontic workups	8
Occlusion adjusted	1
Celluloid crowns placed	3

In addition, the services performed under general anesthesia, were as follows:

Fillings	133
Extractions	26
Root canal fillings	3
Apicoectomies	3

The figures quoted seem to indicate that more work is being accomplished per child and that fewer visits are being made. Of course, many of the children are on a maintenance basis now, but as new patients are accepted at the Center, the picture varies and so does the amount of dental work.

There were actually 15 patients treated under general anesthesia in 1955 and 1956; two of them were treated privately. This figures out to just over 3 per cent of dental patients for the two years.

There are 20 dentists on the staff who serve on a rotating basis. They have learned how best to handle these children, they can recognize the type of cerebral palsy the child has and learn his behavior problems. Thus they are able to manage the child with confidence. Much of the treatment for these children requires the same technics as for any child, with some minor modifications necessitated by the medical and physical condition of each particular patient.

As a result of the participation of dentists in the program of the United

Cerebral Palsy Diagnostic and Treatment Center, Long Island has a nucleus of well-trained dental operators who are able to take care of many of the handicapped children, in their own offices, in those instances where parents wish private care for their children.

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The dental problem of the handicapped child

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The dental problem of the handicapped child recently has become the subject of much discussion. Dentistry has become aware of these unfortunate individuals and the difficulties and problems encountered in ministering to their needs. The profession has accepted the challenge of their dental rehabilitation.

The handicapped child may be afflicted with one of numerous conditions including cerebral palsy, muscular dystrophy, epilepsy, cretinism, mongoloidism and severe emotional block. Some of these children also may have varying degrees of mental retardation.

The amount of destruction in the mouth of the handicapped child will vary with the type and degree of handicap. Bruxism is frequently present. There is often an associated endocrinopathy with partial eruption of the teeth and abnormal gingival manifestations. Chronic discharging fistulas—the result of neglected caries—and hypoplastic enamel, affecting both the deciduous and permanent dentitions, frequently are encountered. Ectopic eruptions, crowded anterior teeth, cross-bites and generalized malocclusions are often seen. Oral hygiene many times is totally inadequate.

A valuable adjunct in the treatment of the handicapped child is the use of a general anesthetic. Endotracheal intubation will permit lengthy periods of general anesthesia, which permits total treatment at one session. Every handicapped child brought to the dental office is not and should not automatically be considered a candidate for operative dentistry under

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a general anesthetic, however. Premedication, and medication in conjunction with local anesthesia, together with patience, tolerance and understanding, often will enable the child to accept treatment in the dental chair.

DEGREE OF COOPERATION OF CHILD

Handicapped children able to be treated in the chair generally can be grouped into the following three broad categories:

1. Children who are capable of being conditioned to accept total treatment in the chair.

The child in this group may have any of the afore-mentioned disabilities, but he may have a mental capacity which coincides with that of the average child. He can be reasoned with, and encouraged to cooperate. Once he exhibits cooperation, local anesthetics in combination with sedatives and antispasmodics may be utilized to promote acceptance of chair treatment.

2. Children who are capable of being conditioned to accept partial treatment in the chair.

Children in this group consist of those whose physical disability or degree of mentality will permit only partial treatment. Some of these children will try to cooperate and they can be conditioned to accept treatment to a degree.

Their appointment sessions must be brief as they tire quickly. Correction of precarious fissures, simple Class I and Class II cavities, simple extractions, prophylaxis and sodium fluoride therapy generally can be performed in the chair. Should lengthy or painful procedures be necessary, arrangements should be made to perform them under a general anesthetic.

Since the child in this group may have to undergo a general anesthetic, the question arises as to why part of his dentistry should be performed in the dental office. Why not perform all of the necessary treatment in the operating room of the hospital? It would be well to remember that there is a child attached to the teeth—a handicapped child, but still a child with emotions and feelings. Such a child is frequently aware, to a degree, of his handicap and realizes that almost everything done for him has been different than that done for other children. Any procedure that he can accept which is similar to one performed for the normal child will give him a tremendous emotional lift.

It is psychologically important that such a child receive as many normal procedures as possible. His acceptance of dental treatment in the dental chair is pointed in that direction. Since one cannot predict which child will accept chair treatment and how much may be accomplished, however, every effort should be exerted towards achieving as much cooperation and performing as much dentistry as can be done successfully before resorting to operatory procedures under a general anesthetic.

3. Children who are completely incapable of being conditioned to accept any treatment in the dental chair.

The child in this group is totally inadequate physically or mentally, or both. Complete treatment at one session under a general anesthetic has proved to be the only satisfactory manner in which dental service can be rendered these unfortunate patients.

USE OF GENERAL ANESTHETIC

The administration of a general anesthetic can be handled best in the operating room of a well-equipped hospital. It is a rare private dental office that is fully equipped to handle all contingencies that may occur during an operation under a general anesthetic. The use of a general anesthetic of brief or lengthy duration is accompanied by risk. Endotracheal intubation has its risks. The modern hospital is prepared with facilities, drugs

and technics to cope with any contingency or emergency. And—most important of all—a capable staff is in constant attendance.

The child requiring a general anesthetic should be admitted to the hospital the afternoon prior to the operatory session, which preferably should be scheduled for early on the following morning. On admission, the child should be given a thorough physical examination by a member of the pediatric staff. This examination should include hemotologic and urologic studies. Chest roentgenograms should be taken when indicated. Preoperative medication, meperidine hydrochloride and atropine or scopolamine, should be given an hour prior to the induction of the anesthetic.

The operating team should consist of two dentists—the operator and an associate—with a dental assistant. The associate's responsibilities are to keep the operative field as well as the entire mouth clean and dry, assist the operator, and take over when directed. The dental assistant is to prepare all the various mixes and keep the flow of instruments and materials going in proper sequence. Arrangements should be made with the x-ray department to have a portable x-ray machine, necessary films, lead-lined gloves and apron, and a technician on hand.

The dental team can scrub during the induction of the anesthetic. Once the anesthesiologist has attained a satisfactory level of anesthesia and the child has been intubated, the x-ray machine can be wheeled into position. If the anesthesiologist has been using an anesthetic agent which is potentially explosive, he will now change to an agent which is safe in the presence of possible sparking. The operator and his associates should stay out of the line of radiation. As an aid in this respect the film should be held in place with a pair of long hemostatic forceps. As an added precaution, the operator should use a lead-lined apron and gloves. A minimum of ten periapical films should be made. These may be supplemented by occlusal plane and extraoral films.

While the roentgenograms are being developed the operator should change into a sterile gown and gloves, and the associate should give the patient a prophylaxis treatment.

A modified sodium fluoride technic should be used since total treatment is planned for the one session. Sterile gauze sponges (2 by 2 or 4 by 4) are saturated with a 2 per cent aqueous solution of sodium fluoride. The mouth is held open by means of a mouth prop and the teeth in the opposing quadrants are thoroughly air dried and covered with the sodium fluoride saturated gauze. Considerable finger pressure should be used to force as much of the sodium fluoride as possible on to the critical tooth surfaces. The mouth prop is then placed in the molar region between the gauze covered quadrants.

Additional sodium fluoride is poured over the gauze to assure a constant and plentiful supply and this should be repeated at intervals while the opposite quadrants are being treated. The gauze is left in position until treatment of the uncovered quadrants has been completed. The original mouth prop is removed and operative treatment started.

The upper quadrant is generally corrected first. On the completion of all operative treatment in this quadrant, the lower quadrant is attended to. The mouth then should be thoroughly irrigated and cleansed to remove all amalgam scraps and debris.

Similar procedures are performed in the quadrants on the opposite side of the mouth. The anesthesiologist can achieve adequate relaxation to allow for manual mandibular closure to check the occlusion after the insertion of any restorations or crowns. Extractions or other surgery should be performed after the completion of all restorative procedures.

The anesthesiologist will then clear

the trachea and pharynx of accumulated secretions or debris and discontinue the anesthetic. The patient is taken to the recovery room and, when fully awake, returned to his room. The child may be discharged from the hospital the latter part of the same day provided his temperature, respiration and pulse are normal. Recovery generally is uneventful.

The child should be seen postoperatively within the week. At that time the parent should be advised to limit the child's intake of caries-producing foods and to see that the patient maintains as high a level of oral hygiene as possible.

OBSERVATIONS

Clinical experience as reported in the literature shows that among pedodontic patients:

1. Caries in the deciduous dentition usually is found on the occlusal and proximal surfaces of the molars and the distal surfaces of the cuspids.
2. Precarious occlusal fissures frequently are present in the first permanent molars.
3. Precarious fissures frequently are present in the buccal grooves of the lower first permanent and second deciduous molars.
4. A caries-free mesial surface of a deciduous molar or a caries-free distal surface of a deciduous cuspid which proximates the carious portion of an adjacent tooth will almost certainly become carious.
5. A caries-free mesial surface of the first permanent molar frequently will become affected by Class I decay where it has contacted distal caries on the second deciduous molar.
6. If the deciduous molars and cuspids in three quadrants of the mouth contain proximal decay, a similar condition usually will prevail in the fourth quadrant.

Items number four, five and six can be expressed by the following formula:

4. CF/C → C/C
5. M.6.CF/C.D.E. → M.6.C/C.D.E.
6. C/C(3Q) → C/C(4Q)

Key:

CF—caries free proximal contacting surface; /—contacting; C—carious proximal contacting surface; → —generally will result in; M—mesial; 6—permanent first molar; D—distal; E—deciduous second molar; (—Q)—in —quadrants.

During a 30 month period 72 children were provided with complete dental service under general anesthesia administered in the operating room of a hospital. These children ranged in age from 2 years and 7 months to 11 years and 4 months. Mirror and explorer examination in conjunction with periapical roentgenographic studies made while the child was under the anesthetic revealed the following:

1. Five children, or about 7 per cent, had no carious interproximal dental surfaces.
2. One child, or approximately less than 2 per cent, had only one carious proximal surface in only one quadrant.
3. Five children, or about 7 per cent, had only one carious surface in two quadrants.
4. Three children, or about 4 per cent, had only one carious proximal surface in three quadrants.
5. No child had only one carious proximal surface in all four quadrants.

These figures, totaling about 13 per cent, constitute the percentage of children who had teeth in which one contacting surface was carious.

6. Eight children, or about 11 per cent, had proximating cavities in adjacent deciduous molars in only one quadrant.
7. Thirteen children, or about 18 per cent, had proximating cavities in adjacent deciduous molars in two quadrants.
8. Fifteen children, or approximately 20 per cent, had proximating cavities in adjacent deciduous molars in three quadrants.

9. Twenty-two children, or about 30 per cent, had proximating cavities in adjacent deciduous molars in all four quadrants.

These figures, totaling about 79 per cent, constitute the percentage of children who had teeth in which both contacting surfaces were carious.

10. Sixteen children, or about 22 per cent, had caries on the mesial surface of the first deciduous molars. Concurrently, the distal surfaces of the contacting deciduous cuspids were carious in 12 instances. About 75 per cent of these contacting teeth were affected.

11. Nine children, or about 13 per cent, had carious distal surfaces on the second deciduous molars proximating the first permanent molar. The contacting first permanent molars had carious mesial surfaces in eight instances or about 88 per cent.

When numbers four and five of the formula are used, the preoperative findings of these children can be expressed as follows:

$CF/C \rightarrow C/C$

approximately 79 per cent in the deciduous molar regions

approximately 75 per cent between the deciduous cuspid and the deciduous first molar

$M.6.CF/C.D.E. \rightarrow M.6.C/C.D.E.$

approximately 88 per cent.

Children who had received complete treatment under a general anesthetic were recalled annually for examination. When recalled, they were given a sedative before being examined. The recall evaluation consisted of mouth mirror and explorer examination augmented by roentgenographic studies. Twenty-eight children were re-evaluated successfully on their recall visit. Their mouths revealed the following:

1. Three children, who had had only one affected proximal tooth surface corrected in one or more quadrants, developed caries on the contacting surface of teeth in six out of seven quadrants—approximately an 86 per cent carious breakdown.

2. Twenty-eight first permanent molars had erupted in seven children since the original treatment. Twenty of these teeth, or about 71 per cent, showed roentgenographic evidence of mesial caries plus distal caries in the proximating second deciduous molars.

3. Seventeen children, or about 61 per cent, who had proximating cavities in both deciduous molars corrected in three or less of the four quadrants, had developed similar carious lesions in the previously untreated quadrant or quadrants.

4. Sixteen children, who had had carious lesions corrected in the distal surface of their deciduous cuspids and the mesial surface of their first deciduous molars in less than four quadrants, developed similar lesions in the remaining quadrant or quadrants—about a 60 per cent breakdown.

5. Four children who, on the original examination, had no interproximal caries, had roentgenographic evidence of multiple interproximal caries on re-examination.

When the recall evaluation findings are compared with the preoperative findings, and expressed algebraically, the following is evident:

$C/CF \rightarrow C/C$

approximately 86 per cent breakdown in all four quadrants

$M.6.CF/C.D.E. \rightarrow M.6.C/C.D.E.$

approximately 71 per cent breakdown

$C/C(3Q) \rightarrow C/C(4Q)$

approximately 61 per cent breakdown in the deciduous molar regions

approximately 60 per cent breakdown between the deciduous first molar and the deciduous cuspid.

ANTICIPATION OF DENTAL REQUIREMENTS

When the afore-mentioned statistical findings are used as a guide, the future dental requirements of the handicapped children can be anticipated. It would be well to keep in mind that such a child presents an impairment which rarely can be completely corrected. The child whose dentistry has to be performed under a general anesthesia will, in all probability, require similar operative treatment at future recall sessions. In the hope that the number of these sessions may be kept at a minimum and be spaced as far apart as possible, the dentist should adopt a much broader concept of operative procedures for maximum protection. In accordance with this philosophy, the following services should be performed:

1. Amalgam restorations should be utilized wherever possible—even at the expense of esthetics.
2. Caries susceptible occlusal grooves and buccal pits of all deciduous and permanent molars should be prepared and filled.
3. Deciduous molars and the distal surfaces of deciduous cuspids which proximate the carious surface of adjacent teeth should have the surface proximating the carious region prepared and restored.
4. Proximal surfaces of deciduous or permanent molars which reveal a Class I cavity should have it developed into a Class II preparation and restored. A simple spot filling, in those instances in which full access to the carious cavity is possible, should not be inserted as such restorations will not render a maximum service.
5. Distal cavities on upper deciduous and permanent cuspids and on the lower permanent cuspids should be prepared with a lingual lock. The lower deciduous cuspids may have a lock on the labial surface.
6. Large Class III cavities on deciduous and permanent incisors should be developed from the lingual surface and should include a lingual lock.

Class III cavity preparations modified with a labial or lingual lock will afford maximum retention and will permit well condensed and contoured restorations.

7. If all the deciduous molars or cuspids in three quadrants have carious proximal surfaces, the proximal surfaces of the analogous teeth in the unaffected quadrant should be prepared and restored.
8. All deciduous molars which have received pulpotomy treatment should be restored with a crown. A crown will provide maximum protection, prevent future carious attacks on the tooth, and prevent the fracture of the lingual coronal plate during advanced resorption of the root.
9. All multiple hypoplastic teeth should be covered with crowns.

SUMMARY

Providing dental care to the handicapped child is a difficult but not insurmountable problem. Many such children can be treated successfully in the dental chair.

Total treatment under a general anesthetic in the operating room should include the eradication of all foci of infection, the re-establishment of a hygienic environment, a maximal sodium fluoride treatment, and the placing of amalgam restorations on all carious as well as caries susceptible surfaces. This implies a series of contacting proximal restorations from the distal surface of the first deciduous molar to the mesial surface of the most posterior tooth in the quadrant, as well as the correction and restoration of any remaining precarious fissures and pits. The mesial surface of the first deciduous molar and the distal surface of the deciduous cuspid should be included in this series of treatments whenever there is evidence of carious breakdown in

these regions. When the remaining healthy enamel appears inadequate to support the usual type of restoration, full coverage of the crown is indicated.

CONCLUSIONS

The handicapped child deserves the best of dentistry—the best of thinking, the best of planning, and the best of service. The use of a general anesthetic has enabled some of these children to obtain dental treatment which formerly they were unable to receive. Operative treatment under a general anesthetic for these children must not be made a hard and fast rule, however. Some handicapped children can be conditioned to accept partial, if not total, treatment in the dental chair. Such conditioning and treatment must be the objective of all those of the dental profession who are interested in the handicapped child. Only in attaining this goal will they be fulfilling a moral as well as a professional obligation.

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The Universe's Inflexible Laws • My professional training was in science and engineering. That is a training in the search for truth and its application to the use of mankind. With the growth of science we have had a continuous contention from a tribe of atheistic and agnostic philosophers that there is an implacable conflict between science and religion in which religion will be vanquished. I do not believe it.

I believe not only that religious faith will be victorious, but that it is vital to mankind that it shall be. We may differ in form and particulars in our religious faith. Those are matters which are sacred to each of our inner sanctuaries. It is our privilege to decline to argue them. Their real demonstration is the lives that we live.

But there is one foundation common to all religious faith.

Our discoveries in science have proved that all the way from the galaxies in the heavens to the constitution of the atom, the universe is controlled by inflexible laws. Somewhere a Supreme Power created these laws. At some period, man was differentiated from the beasts and was endowed with a spirit from which spring conscience, idealism and spiritual yearnings. It is impossible to overlook that there is here a divine touch and a purpose from the Creator of the universe. These things can be expressed only by religious faith.

From such religious faith, our Founding Fathers enunciated the most fundamental law of human progress since the Sermon on the Mount, when they stated that man received from the Creator certain inalienable rights and that these rights should be protected from the encroachment of others by law and justice.

The agnostic and atheistic philosophers have sought to declaim progress in terms of materialism alone. But from whence come the morals, the spiritual yearnings, the faith, the aspirations to justice and freedom of mind which have been the roots of our progress?

Growing societies always record their faith in God; decaying societies lack faith and deny God.

America is not a decaying society. It remains strong. Its faith is in compassion and in God's intelligent mercy.—*Herbert Hoover, I See No Doom Down an Alley.*

American Dental Association testimony before FTC on need to change "Trade Practice Rules for the Commercial Dental Laboratory Industry"

The Federal Trade Commission on February 4 held a public hearing in Chicago to receive information on the need to amend the "Trade Practice Rules for the Commercial Dental Laboratory Industry." Testimony was received from six representatives of the American Dental Association. Copies of the complete statements are available on request to the Council on Dental Trade and Laboratory Relations. Excerpts from the testimony of the Association representatives appear below:

Walter E. Dundon, Chicago, Chairman, Council on Dental Trade and Laboratory Relations • In 1954 the National Association of Dental Laboratories requested the Federal Trade Commission to approve and promulgate trade practice rules for the commercial dental laboratory industry. At the first formal conference on this matter, in New Orleans in September 1954, the American Dental Association representatives suggested that the *Rules* accurately state the functions of the dental laboratories and their relation to the dental profession.

In June 1955 representatives of the American Dental Association testified before representatives of the F.T.C. and recommended that the language in the preliminary draft of the code which indicated that the dental laboratories are responsible for the design, appearance, comfort, occlusion or fit of a prosthetic or orthodontic appliance be eliminated. The representatives also recommended that the *Rules* clearly describe the proper relation of the dental laboratory to the dentist by declaring that only licensed dental practitioners and other persons authorized by state law may lawfully deal with dental laboratories.

On November 4, 1955, the F.T.C. promulgated the *Rules*. These *Rules* were not acceptable to the American Dental Association. Accordingly, the Board of Trustees of the Association directed the Council on April 3, 1956, to seek amendment of the *Rules*. Satisfactory amendments were not made to the *Rules* with the result that the House of Delegates of the Association, at its October 1956 annual session, adopted a resolution directing the Council to seek amendment of the *Rules* with particular regard to the terms "design" and "occlusion" and to obtain a clear statement defining the adjunctive relation of the dental laboratory craft to the dental profession.

The policy of the American Dental Association has always been that dental laboratory technology is a craft which operates as an adjunct to the dental profession and is not an independent industry. The Association is formally charged in its charter and bylaws with the "improvement of the health of the public" and the Association believes that the *Rules* may adversely affect the discharge of this obligation. The Association also believes that in its mission of improving the public health, the ethical dental laboratories should be given appropriate safeguards so that they can continue to render an essential service to the dental profession and the legal practitioner of dentistry.

Harry Lyons, Dean, School of Dentistry, Medical College of Virginia, and President, American Dental Association • The American Dental Association objects to the definition of the "industry for which these rules are promulgated" for the following reasons:

1. The Commission's definition of the commercial dental laboratory industry does not describe adequately the legitimate function of commercial dental laboratories.

The primacy of state governments in the regulation of the health professions is well established. The leading case in the dental field on this point is Semler v. Oregon State Board of Dental Examiners, 294 U.S. 608.

Every state has exercised its legislative prerogatives in the area of dental health services by enacting statutes regulating the practice of

dentistry. The state dental practice acts establish the basic legal relation between the dentist and the dental laboratory. The state laws provide that the manufacture of a dental appliance is part of the practice of dentistry, and that an unlicensed person may not engage in any phase of the manufacture of a dental appliance unless he does so at the direction and under the supervision of a licensed dentist.

The Association does not concede, nor do we believe, that the Commission wishes to create the inference, that any agency of the federal government would alter, affect or modify in any way the basic relation between dentist and laboratory, since that relation is determined solely by the sovereign states. The Association, therefore, questions the right of the Commission to describe the function of commercial dental laboratories in a manner which does not reflect accurately the legitimate limitations affecting that function prescribed by state laws. The Association also wishes to remind the Commission that it is dealing here with an activity and a commodity that vitally affect the health of the community.

The Association insists that the Commission must not expand or contract in its *Rules* the relative position in which the dentist and the laboratory are placed by the state laws.

State dental laws have a direct and immediate bearing on the activities of commercial dental laboratories. The Association urges the Commission to recognize in its prefatory statement, or elsewhere in the *Rules*, the impact of state dental laws on the relation between the dentist and the dental laboratory, and the effect of state laws on the function of a dental laboratory and the market for industry products.

There is a substantial possibility of serious abuse of the *Rules* if the *Rules* do not reflect faithfully the applicable provisions of state laws. The Commission is not dealing here with an industry that is free to find its own market. The dental laboratory industry is not an independent industry, but must restrict its marketing activities solely to members of the dental profession. Although the Association recognizes that the *Rules* do not of themselves have a legislative effect, any pronouncement from as important a governmental agency as the F.T.C. can be seized on by the unscrupulous for exploitation in other areas.

2. All commercial dental laboratories are not included within the literal scope of the Commission's present definition of the commercial dental laboratory industry.

The commercial dental laboratory industry has a dual personality. The ethical members of the industry adhere strictly to the requirements of state dental laws and restrict their business contacts to licensed practitioners of dentistry. The ethical laboratories do not solicit or accept patronage from the general public. The "bootleg" laboratories solicit and accept patronage directly from members of the public—a practice which conflicts with state dental laws. The bootleg or illegal laboratories are not included within the Commission's present definition of the commercial dental laboratory industry since these laboratories do not manufacture dental appliances "pursuant to oral or written instructions and/or from impressions, casts or models furnished by a licensed practitioner of dentistry. . . ."

Since the Commission has failed to include all commercial dental laboratories within its jurisdictional definition, the subject *Rules* cannot be effective on an "industry-wide basis."

The *Rules* can be given industry-wide application if the Commission will define the commercial dental laboratory industry in terms of its function, as follows:

> "Members of the industry are those persons, firms, corporations and organizations engaged in the construction of dental appliances."

The ethical laboratory which constructs a dental appliance at the direction and under the supervision of a licensed dentist makes an important contribution to the ability of that dentist to render an increased measure of health care to the public. The bootleg laboratory takes an illicit profit at the expense of the health of the community and threatens at the same time the economic well-being of the members of the ethical dental laboratory craft.

3. The Association objects to the Commission's definition of the commercial dental laboratory industry since the present definition inappropriately includes within its literal scope those dentists who maintain laboratory facilities as an integral part of their dental practices.

The Association's Bureau of Economic Research and Statistics, in a 1956 survey of dental practice, found that 29.6 per cent of all laboratory work performed during 1955 was accomplished in the laboratory facilities maintained in dental offices; that in 1955 dentists employed 2,900 dental laboratory technicians on a full-time basis, and that more than 300 dentists employed dental laboratory technicians on a part-time basis. The Commission in its prefatory statement should incorporate the following sentence:

> "Licensed practitioners of dentistry and their employees are not members of the industry for which these *Rules* are established."

Raymond J. Nagle, Dean, New York University College of Dentistry, and Professor, Dental Prosthetics • The American Dental Association objects to the use of the term "design" within the prefatory "Statement by the Commission" and in Rule 1 and Rule 2 because the "design" of a dental prosthesis is the responsibility solely of a dentist. The doctor of dentistry is equipped through education to comprehend and understand the many biologic and biomechanical factors involved in the design of a dental prosthesis. Design actually is contained within and is part of diagnosis, treatment planning, and prognosis, all of which are important professional services within the practice of dentistry.

A complete history and collection of related data concerning the general health of the patient are necessary for the success of the prosthetic restoration. Dentures, when fitted for patients not physically or mentally well, often prove unsatisfactory and frequently fail. The oral structures commonly demonstrate objective and subjective symptoms which frequently contraindicate the use of certain types of prosthesis and demand a design completely different from that which would be conventional under average conditions. Oral diagnosis is only possible when all data have been collected, correlated and supplemented by adequate roentgenograms and casts mounted on an adjustable instrument by scientific methods of transfer. Only the dentist is legally and professionally competent to carry through and supervise these procedures.

Among the factors that influence treatment planning or "design" are the following: the age and sex of the patient, the relation of the lip to the remaining structures, caries, and the membranes of the mouth and oral cavity.

When the word "design" is used, the dentist visualizes something much deeper and more complex than the pencil marking of a stone or plaster cast made from an impression of the mouth. Whereas "design" actually is part of the "plan of treatment," each is dependent on the other. By law and by virtue of his basic scientific education, the dentist is solely responsible for this health service to the patient and to the community. "Design" or "plan of treatment" in no logical manner can be interpreted as the responsibility of the dental laboratory technician or commercial dental laboratory, nor is it possible to divide this responsibility between the dentist and the laboratory.

J. Eugene Ziegler, Director, School for Dental Laboratory Technicians, University of California, Los Angeles • The design or plan of treatment for each patient is a variable which receives definition only after a competent evaluation is made by the dentist of the systemic and oral health of the patient, the age and sex, and the position, firmness and vitality of the remaining teeth, the condition of the alveolar bone, the presence of abscesses or cysts, the condition of the gingivae and ridges, the mental attitude and oral hygiene habits, the relation of the lips to the remaining oral structures, and so forth. This information cannot be obtained from an examination of stone casts or models of the dental arches.

After the dentist has decided on the treatment program best suited to the requirements of his patient, the dentist must prepare the patient's mouth to receive the dental prosthesis. The dentist may desire to place gold restorations on the abutment teeth for the purpose of joining one or more of them together for greater strength, or for the purpose of preventing or controlling dental caries, or for the purpose of increasing retentive areas, or for the purpose of installing precision attachments. If clasps are used, he must cut "rest areas" to prevent the denture from settling under stress. It may also be necessary to move or extract a tooth or teeth, or to reduce the height or width of a tooth or teeth.

When the preparatory procedures have been completed, the dentist takes an impression of the dental arches. The impressions and the casts made from the impressions are the foundations on which the dental appliance is fabricated. It should be noted that when the dentist has completed the procedures which are necessary to prepare the mouth for the insertion of a dental appliance, the dentist has thereby irrevocably established the design of the appliance. Since the laboratory procedures are necessarily based on the impression and casts or models supplied by the dentist, the laboratory cannot contribute to the design of the appliance. The design of the appliance is inherent in the impression taken by the dentist on the prepared oral structures and is reflected in the casts or models.

If the dentist desires to make use of the facilities offered by a commercial dental laboratory, he will send the impression or the casts to the laboratory with instructions as to the work which is to be accomplished. The work is constructed by the laboratory and returned to the dentist for try-ins and adjustments. On approval by the dentist, the appliance is returned to the laboratory for final processing. When the appliance is completed, it is returned to the dentist for fitting in the patient's mouth. At that time the teeth are ground by the dentist to fit the opposing teeth in all ranges of function.

The Association's objection to the use in the *Rules* of the term "design" also applies in relation to orthodontic appliances. The devices

used in orthodontic treatment are mobile and dynamic, in contrast to the relatively stable nature of a prosthetic device. The orthodontic device customarily requires continuing supervision and frequent adjustment by the dentist, whereas the prosthetic device requires only periodic attention. The very nature of an orthodontic device and the necessity that it be adjusted frequently in the mouth of the patient are additional reasons why the Association believes that the word "design" must be deleted from the Commission's prefatory statement and from Rules 1 and 2.

John R. Thompson, Chicago, Professor of Orthodontics, School of Dentistry, Northwestern University • The Association objects to the term "occlusion" as used in the *Rules* because the dentist alone is qualified to diagnose, plan and direct the occlusion of the natural or artificial teeth.

The concept of occlusion has expanded with each passing year in dentistry's progress as a profession. The understanding and application of occlusion in its fullest meaning has been learned and practiced by the dental profession as its knowledge of the anatomy, the physiology, the growth and aging process of the teeth and their supporting tissues, the facial structures, the jaw joints and the musculature, increased. For the dentist to understand and apply this in practice requires many years of study that extend even beyond the time of formal dental education.

One of the services that the technician is requested to perform is the arrangement of artificial teeth on a mechanical instrument. Although this has sometimes been referred to as establishing occlusion, it is actually arranging the teeth in interlocking positions. It would be more correct to call this "setting up" the teeth or "making a set-up."

After harmony of the mechanical arrangement of the teeth with the function of the jaw joints and musculature has been established in the mouth of the patient by the dentist, the set-up is given to the technician for processing. The dentures are then returned to the dentist for the final evaluating of jaw position and function and for the final correction of occlusion that can be done only directly in the mouth of the patient, or after new relation or occlusion records are obtained from replacement of the appliance in the patient's mouth.

The occlusion of the teeth involves all the structures of the masticating system. Faulty occlusion of the natural or artificial teeth is responsible for abnormal function of this system which invariably has serious consequences. The occlusion must be arranged so that normal harmonious function of all of the parts of the system is carefully preserved or restored. This is the full and complete responsibility of the dentist.

Renah Camalier, Washington, D. C., Attorney • Representatives of the American Dental Association have presented again today the objections of the dental profession to the *Rules* promulgated by the Federal Trade Commission on November 4, 1955. Expert testimony has indicated how some of the *Rules* are incompatible with the legal and historic relationship existing between the dentist and the dental technician or laboratory.

The Association, in its desire to cooperate with the Commission, has urged certain amendments which, if adopted, would enable the *Rules* to operate without offending basic concepts underlying the profession of dentistry. The Association's recommendations may be summarized as follows:

1. The definition of the commercial dental laboratory industry or craft should be amended (1) to apply the *Rules* to the commercial practices of all persons or entities who manufacture dental appliances, except licensed and practicing dentists and their office personnel; (2) to delete therefrom those terms, such as the term "design," which inaccurately describe the proper and legal function of a dental technician, and (3) to indicate the applicability of state dental laws and other statutes to the relation between the dentist and the dental technician or laboratory.

2. Terms, such as "design" and "occlusion," inaccurately describing the function of a dental technician or laboratory, should be deleted from the *Rules*.

3. Sections III and IV of Rule 12 and Rule 13, treating with advertising or promotional allowances, special services in connection with the resale of a commodity, and exclusive agreements, should be deleted as these provisions have no meaningful application to transactions to which a dentist is a party.

4. The jurisdiction of the *Rules* should be expanded to encompass both the ethical and nonethical segments of the industry.

COUNCIL ON DENTAL HEALTH
BUREAU OF ECONOMIC RESEARCH AND STATISTICS

Determination of costs for programs for the group purchase of dental health care

The history of plans for the group purchase of dental health care has established the fact that the state dental society is the most effective agency through which professional advice and assistance can be made available to groups desiring to establish such plans. The experience already gained through the operation of group purchase plans indicates that they can be designed, developed and operated successfully in the mutual interest of the public and the dental profession if they are based on factual information which is understood and applied.

State dental societies have assisted in developing various group purchase plans, such as those operated by public welfare agencies, the Farm Security Administration, the Veterans Administration and health and welfare funds of labor unions. There were few, if any, ready solutions to the problems which presented themselves, nor were dental societies uniformly well organized so that the responsibility for solutions could be assigned to agencies within their structure. As a result, problems were attacked individually on an emergency basis through a wide variety of administrative mechanisms. The dental profession proved that it could and would rise to the occasion and, in general, the programs developed were sufficiently successful to stimulate the desire for more and larger projects.

It has become increasingly clear that the experience gained by state dental societies through the costly and difficult process of "crises operation" can and should be translated into an acceptable philosophy, specific policy and a continuing long-term program for gathering of information on plans for the group purchase of dental health care. The Council on Dental Health of the American Dental Association believes that this translation is a proper assignment for a state council on dental health.

Probably the greatest amount of controversy and misunderstanding in the development of plans for the group purchase of dental health care centers around the problem of determining the costs of the care and relating those costs to the scope of benefits to be provided.

When an agency desiring to develop and operate a group purchase program approaches a dental society for assistance, the dental society must be able to provide it with the type of information which the individual dentist provides an individual patient in consummating an agreement to render dental health care. The dentist must determine the dental health needs of the individual; he must know the costs of the dental health care, and he must be able to relate the type of care to the financial resources of the individual. The dental society must be able to develop its information in terms of the dental health needs of the group for which the care is to be purchased, it must know the fees of the dentists who will

render the care, and it must know the financial resources of the agency which proposes to purchase the care.

The dental health needs of any group of individuals can be determined through established methods of examination and recording. The survey for a specific group can be accomplished with the assistance of the public health dentist, the dental schools in the area or by the state council on dental health alone. The agency which will operate the program can provide the information as to available financial resources.

The method of approaching the specific problems of individual plans as they arise has resulted in repeated surveys of fees in segmented areas of dental health care. The purpose of these surveys has been limited to the development of separate fee schedules for separate plans, none of which provided a comprehensive program of dental health care benefits.

The Council on Dental Health of the American Dental Association feels that state dental societies, through their councils on dental health, should now establish continuing programs for determining the fees of dentists in their respective states for all procedures involved in dental health care. It believes, further, that the information to be derived from such studies is essential to the proper development of the dental societies' total program and can provide guidance to all of the agencies in dental organizations in developing and improving their programs.

In addition, it would provide a sound basis for an acceptable policy relative to fee schedules. It would simplify the problem of advising and assisting agencies which desire to establish or expand group purchase programs, as to what benefits should be included in the program, or added to an existing one, within the limitations of its financial resources.

The Council believes that the fee survey questionnaire should include all of the general classifications of dental procedures, such as oral surgery, operative dentistry, prosthetics, periodontics, pedodontics and endodontics, as well as the treatment of acute medical and surgical conditions carried out in a hospital by dentists. Under the foregoing classifications, each procedure for which a specific charge is made should be listed.

The questionnaire should be sent to all of the dentists practicing in the state or, in the larger states, to a representative sample of all of the dentists. To be of most value to the membership, the report of the survey should show the number of dentists charging each fee amount (frequency distributions). The results of the survey should also be presented by geographic region within the state or by district dental society.

The distribution of the questionnaires should be preceded by an intensive program of information to the members so that they are made aware of the value and importance of the data which will be compiled from the study. The survey program should be repeated at a minimum of two-year intervals in order that the data be kept current. Continuing consideration should be given also to refinement and expansion of the questionnaire as well as to the kinds of information which may be obtained from the data that is reported.

CONDUCTING THE FEE SURVEY

Since 1950, the Bureau of Economic Research and Statistics has assisted more than 40 state dental societies and several district societies in conducting dental fee surveys. Most of these surveys have been conducted primarily to obtain a factual basis for negotiating dental fee schedules with the Veterans Administration. Some of the surveys, particularly those conducted by district societies, have been conducted mainly for the purpose of informing the society membership as to the prevailing fee structure.

The assistance provided by the Bureau

to societies making dental surveys is of three types:

1. Provision of questionnaires.
2. Provision of technical advice regarding sampling and procedures.
3. Preparation of summary report of survey results.

The Questionnaire • Questionnaires are furnished without charge to the state or district society making a survey. A new questionnaire has been developed which is comprehensive and will provide a basis for fee schedules in any type of program.

Questionnaires can be furnished with the name and address of the society imprinted at the top of the first page. No charge is made for this feature. If the imprint is desired, its exact wording should be included in the order for questionnaires. Ordinarily, questionnaires are shipped to the society within four days without the imprint and within ten days with the imprint.

Technical Advice • Most state and district dental societies should send questionnaires to every active dentist within their boundaries in order to obtain a sufficient number of replies for reliable results. Usually, about one-fourth or one-third of the dentists who receive questionnaires will return them. Nonmembers of the society should be included in the mailing if results are to give a true picture of dental fees in the state or community.

In some states, the number of dentists is large enough so that reliable statistics can be obtained from a representative sample of all dentists at a considerable saving of cost. For example, in a state having about 4,000 dentists, questionnaires may be sent to every second dentist on an alphabetical list. Of 2,000 questionnaires sent out, probably at least 500 will be returned, a number adequate to provide reliable statistics.

There is, of course, no need to send questionnaires to dentists engaged in employment other than private practice. Often it is difficult to eliminate these dentists from the list, however, and apparently no harm results from including them in the mailing.

It is recommended that a letter be enclosed with the questionnaire, encouraging reply and emphasizing the importance of accurate figures. It is generally believed that in mail surveys a better return is achieved if a business reply envelope (no stamp required) is enclosed.

The returned questionnaires are processed by the society conducting the survey. The first step in the processing is editing the questionnaires. This operation consists of marking out obviously erroneous answers or correcting such answers when possible. Some dentists may record fees on an hourly basis; such fees will have to be marked out and counted as "no answer." Despite instructions to the contrary, some dentists will record a range of fees instead of the single, most usual fee for a dental operation. Where the range is given, it must be stricken in the editing process.

The second step by dental society personnel in processing returned questionnaires is to tally the responses; that is, prepare a frequency distribution for each question. Following is an illustration of a frequency distribution.

One-surface amalgam filling

Fee	*Number of respondents*
No answer	8
$ 1.00	2
2.00	5
3.00	29
3.50	26
4.00	50
5.00	21
6.00	17
7.00	2
8.00	5
10.00	7
Total	172

Preparing such a distribution does not require special training but should be done by someone who is accurate. The job is simply to count the number of dentists reporting each fee amount for each question.

Preparation of Report • The society conducting the survey sends the frequency distribution for each question to the Bureau of Economic Research and Statistics of the Association. The Bureau prepares a report, consisting of the mean, median, mode, 10th and 90th percentiles for each question. This report is Mimeographed, and as many copies as the society needs are furnished without charge.

It is suggested that the frequency distributions be made available to members of the society for study, since they contain much more detailed information on prevailing fees than is presented in the report prepared by the Bureau. Usually it will not be practical to publish the distributions in the society's journal because of the amount of space required. Probably the frequency distributions should be Mimeographed and notice placed in the society's journal to the effect that they are available on request.

Societies interested in making dental fee surveys are invited to send any questions regarding this project to the Bureau of Economic Research and Statistics.

APPLICATION OF SURVEY DATA IN DETERMINATION OF COSTS

Dentists are legitimately concerned with the term "fee schedule" and its effect on their right to determine for themselves the economic standards of the practice they choose to conduct. Purchasers of dental health care also are legitimately concerned with the costs and essentiality of the benefits which they agree to provide for their beneficiaries from their available resources. The Council on Dental Health believes that these two concerns can be resolved through a clear understanding of the principles involved as well as the rights and responsibilities of both the agency which is purchasing the dental health care and the dental society.

It is an accepted principle that sound programs for the group purchase of dental health care can be operated only through the ethical, organized dental profession. It should be re-emphasized that when an agency which desires to develop and administer a program of group purchase approaches a dental society for assistance, the dental society must be able to provide it with the same information which the individual dentist provides the individual patient in consummating an agreement to render dental health care. Because the dental society represents a wide variety of economic standards of dental practice, it cannot establish a fixed cost of services that will make all of the dentists in the society available to the plan.

With the information developed through such a study as previously described, the dental society can tell the purchasing agency how to make the best use of the financial resources it has available for dental health care. The society can assist in the establishment of priorities for types of care and the scope of benefits which will be provided. It can also advise the agency regarding the proper fee schedule that should be established so that the volume and character of service can be provided within the limitations of available funds. In other words, based on the advice of the dental society and a thorough study of the society's comprehensive cost data, the agency should be able to determine the schedule of benefits it will provide for its beneficiaries and a schedule of fees or allowances it will agree to pay the dentists for the services rendered. If the dental society's cost data are sound, the purchaser should be able to provide the benefits described within the limitations of the available financial resources. There is no need for the den-

tal society to endorse or authorize the fee schedule or in any way commit its members to participate in the plan under a fixed fee schedule. The schedule of fees or allowances will be the schedule of the particular plan and can be adjusted by the administrators of the plan to expand the scope and character of benefits provided. The fee schedule itself should be the instrument of the purchasing agency and should not carry the endorsement or approval of the dental society.

As an extension of the first principle of the American Dental Association's "Principles for Determining the Acceptability of Dental Prepayment Plans (Revised, 1956)," the dental society has the responsibility of providing accurate information on which an agency desiring to purchase dental health care can base the schedule of fees it will pay for the most effective dental health care benefits it can purchase for its beneficiaries. The dental society has the further responsibility of assisting in the evaluation, refinement, expansion and development of the program in the best interests of the patients and the dentists.

If a state dental society has accurate information regarding the fees of dentists in the state, it will be in a position to advise and assist any agency in developing a sound program for the group purchase of dental health care regardless of the characteristics of the group or the benefits it chooses to purchase.

Availability of such data is particularly important at the present time with the advent of the Medicare program for dependents of military personnel that involves the purchase of dental health care under two separate categories: (1) hospital dental practice for the treatment of acute medical and surgical conditions; (2) dental health care which is adjunctive to the resolution of an acute medical or surgical condition which is under the care of a physician. The first category will include those oral surgical procedures performed in the hospital. The second category may include almost any procedure or combination of procedures of dental practice if they are essential to the resolution of the primary cause of admission. The beneficiaries under this program will be, largely, dependent wives and children. Although the dental benefits are restricted, there is reason to believe that the program will be expanded and provide more comprehensive dental benefits. Dental societies can expect to be involved in continuing requests for assistance in the development of the Medicare program.

With the recent amendments to the Social Security Act which provide a separate matching formula for health care costs, dental societies will be called on to assist in the development and expansion of dental health care programs for a wide variety of public welfare recipients in the four categories of public assistance welfare which the federal government will support through grants to states.

The individual dental health care programs which will be authorized under the dependent care and public assistance programs will be restricted to certain groups of people, and each group will have its particular scope of benefits. The combination of programs, however, will involve the entire scope of dental health care and will require that the dental society have available accurate and current information on the costs of care.

The problems involved in determining the costs of dental health care for group purchase programs provide ample justification for a state dental society to develop a continuing comprehensive study of the fee structure in its state. The information which the study will make available will also assist the society in solving many other problems in its basic program of improving the dental health of the public and the art and science of dentistry.

An example of such a benefit is the one that will accrue to the society's pro-

gram of continuing professional education of the membership through its own scientific programs, its journal and the professional education programs of the state health department and the dental schools.

In planning such a program, the dental society, through its council on dental health, should make the optimum use of the services of those agencies which can assist and cooperate in the project.

COMMENT

The Bureau of Economic Research and Statistics of the American Dental Association is prepared to advise and assist in the development of the questionnaires and technics for conducting a survey on fees. It can also be of assistance in indicating what information can be recovered from the basic data. The dental society should be able to determine the scope of the questionnaire, inform the dentists as to the importance of the study and distribute the questionnaire. In addition it should make the initial classification of information.

The dental society should look to the dental division of the state health department for technical advice and assistance in statistical research. The state health department in several states has agreed that the costs of dental health care in the state are of public health significance and that the transfer of information to punch cards and the mechanical compilation of information from them constitutes a proper function of the department's bureau of statistics. Particularly in those state societies where a limitation of funds would deter the initiation of the program should the assistance of the public health department be sought.

COUNCIL ON DENTAL RESEARCH

Supplement to the list of certified dental materials

ADDITION • Since the publication of the most recent List of Certified Dental Materials, revised to December 1, 1956 (J.A.D.A. 54:130 Jan. 1957), the following materials which conform to American Dental Association specifications have been added.

CERTIFIED DENTAL INLAY CASTING INVESTMENTS

(A.D.A. SPECIFICATION NO. 2)

Investment	*Manufacturer or distributor*
S. S. White Formula 25	The S. S. White Dental Mfg. Co.

CERTIFIED DENTAL INLAY CASTING GOLD ALLOYS

(A.D.A. SPECIFICATION NO. 5)

Alloy		*Manufacturer or distributor*
Jelenko J-9	Type C, hard	J. F. Jelenko & Co., Inc.

COUNCIL ON INSURANCE

Endorsements attached to Association-sponsored accident and health insurance master policy

The Council on Insurance announces that two endorsements have been attached to Master Policy G-2100 issued by the National Casualty Company which should be of interest to those who carry the accident and health insurance sponsored by the American Dental Association.

One of the endorsements extends the grace period for the payment of premiums from 10 to 31 days.

The other endorsement extends the accidental death and dismemberment benefits so that it is now elective with the certificate holder to collect either the lump sum dismemberment benefits or receive monthly indemnity benefit payments for the period of the disablement up to the maximum period of five years. The text of this endorsement follows:

If, within ninety (90) days from the date of the accident, "such injury" shall cause death, the Company will pay the Accidental Death Benefit applicable to the Insured, as written in Statement 7 of the application, and in addition will pay the Monthly Accident Benefit applicable to the Insured, as written in Statement 7 of the application, up to the date of such death. If, within ninety (90) days from the date of accident, "such injury" shall result in any of the following dismemberment losses, the Insured may request payment of the Accident Dismemberment Benefit applicable to the Insured, as written in Statement 7 of the application, and in addition the Monthly Accident Benefit applicable to the Insured, as written in Statement 7 of the application, up to but not beyond the date of such dismemberment loss; if such request for the Accident Dismemberment Benefit for the dismemberment loss occurring within ninety (90) days is not made, the Company will pay the Monthly Accident Benefit applicable to the Insured, as written in Statement 7 of the application, for the period of disability sustained by reason of such dismemberment loss, but in no event shall the Insured receive less benefit for the dismemberment loss than the amount specified applicable to the Insured, as written in Statement 7 of the application, for such loss.

COUNCIL ON DENTAL THERAPEUTICS

Council announces classification of additional products: a correction

The following should be substituted for the information listed under *Ravocaine HCl 0.4%, Novocain 2% with Cobefrin 1:10,000* (Cook-Waite Laboratories, Inc.) on page 380 of the March 1957 issue of THE JOURNAL: . . . Marketed in 2.2 cc. minimum cartridges and in 30 cc. multiple dose vials.

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

The 1956 survey of dental practice
VII. Number of patients and patient visits

Dentists returning questionnaires were asked to indicate, if possible, the number of patients (individuals) treated or examined in the office during 1955. They were also asked to record the number of patient visits (sittings) during 1955.

Most dentists do not keep a record of the number of persons coming to the office for dental care during a year. Nearly half of the respondents declined to answer this question, and many of those who did answer gave rough estimates. For these reasons, the information obtained on number of patients is regarded as less accurate than most information gathered in the survey.

It is believed that information submitted on number of patient visits is relatively accurate because a dentist can usually make a close estimate by counting the number of appointments during a typical week and multiplying by the number of weeks worked. In fact, undoubtedly many dentists provided precise information on this question by counting the number of appointments for the year in the appointment book.

Although the mean number of patients reported by nonsalaried dentists was 1,056, responses were scattered broadly about this figure (Table 42). The dispersion of dentists with respect to number of patients was so great that it is virtually impossible to typify a dentist with respect to this factor. A few dentists reported a very large number of patients, which, of course, brought up the mean.

The median of 796 patients better describes the typical dentist, although Table 42 shows that large percentages of dentists reported less than half this number.

The mean number of patient visits was 2,977, or 2.8 visits per patient, the same ratio as was found in 1952. As shown in Table 43, the "scatter" of dentists according to number of sittings reported was less pronounced than the scatter by number of patients. Nearly one third of the respondents reported between 2,000 and 3,000 sittings.

In 1952 the mean and median number of patients were 1,012 and 724; the mean number of patient visits was 2,872. The percentage increase in mean number of patients during the three-year period was 4.3 per cent.

LOCATION OF THE DENTIST

Dentists in the Southeast region averaged about twice as many patients as dentists in the Middle East. This is not surprising in view of the fact that the population-dentist ratio is more than twice as high in the Southeast as in the Middle East.

The ranking of regions with respect to average number of patient visits is not the same as the ranking with respect to number of patients (Table 44). The ratio of number of patient visits to number of patients varies considerably among the regions, from a high of 3.9 in the Middle East to 3.3 in New England, 2.7 in the Far West, 2.6 in the Central region, 2.4 in the Northwest, 2.4 in the Southeast and 2.2 in the Southwest. Low ratios of patient visits to patients could result from two factors: (1) relatively low in-

The first six articles in this series appeared in The Journal for November and December 1956, January, February, March and April 1957.

Table 42 • Percentage distribution of independent dentists by number of patients in 1955

No. of patients	Per cent of dentists	Cumulative per cent
— 99	1.7	1.7
100— 199	4.4	6.1
200— 299	8.3	14.4
300— 399	8.8	23.2
400— 499	7.5	30.7
500— 599	9.1	39.8
600— 699	5.2	45.0
700— 799	4.5	49.5
800— 899	5.2	54.7
900— 999	4.4	59.1
1,000—1,099	8.7	67.8
1,100—1,199	1.6	69.4
1,200—1,299	4.8	74.2
1,300—1,399	1.2	75.4
1,400—1,499	1.3	76.7
1,500—1,599	5.2	81.9
1,600—1,999	3.6	85.5
2,000—2,399	5.8	91.3
2,400—2,799	2.9	94.2
2,800—3,199	1.7	95.9
3,200—	4.1	100.0

cidence of dental disease or (2) failure of dental patients to obtain all needed treatment, probably because of economic conditions.

The average number of patients by city size, and for four large cities, is shown in Table 45. It is interesting to note that the ranking of city-size categories with respect to this variable is considerably different from their ranking with respect to income of dentists as shown in Table 7, Chapter II. The income of dentists per patient shows much variation according to both city size and region of the country.

The number of patients per dentist was much lower in the City of New York than in Chicago, Los Angeles or Detroit. For Los Angeles, the mean number of patients was more than twice the median, indicating that a few respondents from that city reported unusually large numbers of patients.

Dentists practicing in residential districts tended to have fewer patients than dentists in downtown or other business districts (Table 46). It is believed that most of the very large dental offices—those employing several auxiliary personnel and sometimes salaried dentists—are in the business rather than the residential section.

Table 43 • Percentage distribution of independent dentists by number of patient visits during 1955

No. of patient visits	Per cent of dentists	Cumulative per cent
— 499	2.7	2.7
500— 999	4.2	6.9
1,000—1,499	7.4	14.3
1,500—1,999	12.6	26.9
2,000—2,499	17.0	43.9
2,500—2,999	14.5	58.4
3,000—3,499	12.7	71.1
3,500—3,999	9.0	80.1
4,000—4,499	6.7	86.8
4,500—4,999	4.0	90.8
5,000—5,499	3.0	93.8
5,500—5,999	1.0	94.8
6,000—6,499	1.6	96.4
6,500—6,999	.4	96.8
7,000—	3.2	100.0

AGE AND TYPE OF PRACTICE

The number of patients treated annually by a dentist tends to increase with age until age 50; thereafter the number declines in each higher age group (Table 47). This is true of a majority though not all dentists. The decline is slow at first, becomes abrupt in the late fifties and early sixties, then again becomes more gradual. Dentists 70 and over reported almost exactly as many patients as dentists aged 25 to 29. Undoubtedly many survey participants over 70 were in partial retirement, whereas the age group 25 to 29 included 1955 graduates who worked only a few months during the year.

Part of the severe variation in number of patients shown in Table 42 is explained by Table 48, which shows the average number of patients according to type of practice. The two extremes are the oral surgeons, who reported a mean of 2,130 patients in 1955, and the orthodontists, with a mean of only 311 patients. The

Table 44 • Average number of patients and patient visits of independent dentists in 1955, by region

Region	Average no. of patients		Average no. of patient visits	
	Mean	Median	Mean	Median
New England	858	604	2,813	2,550
Middle East	768	498	2,998	2,550
Southeast	1,364	1,002	3,334	2,940
Southwest	1,268	997	2,727	2,475
Central	1,120	802	2,933	2,502
Northwest	1,178	925	2,811	2,497
Far West	1,083	732	2,976	2,598
United States	1,056	796	2,977	2,517

Table 45 • Average number of patients of independent dentists by size of city and for four large cities, 1955

City size or city	Mean no. of patients	Median no. of patients
Under 1,000	1,060	740
1,000— 2,500	1,270	1,001
2,500— 5,000	1,369	1,004
5,000— 10,000	1,115	945
10,000— 25,000	1,153	897
25,000— 50,000	1,056	802
50,000— 100,000	1,065	750
100,000— 250,000	1,091	753
250,000— 500,000	1,066	653
500,000—1,000,000	999	653
Over 1,000,000	735	490
United States	1,056	796
New York	571	354
Chicago	718	502
Los Angeles	1,248	550
Detroit	906	798

Table 46 • Average number of patients of independent dentists in 1955, by city section

City section	Mean no. of patients	Median no. of patients
Downtown	1,062	651
Neighborhood business district	1,018	704
Residential district	893	504
Suburb-business district	1,247	797
Suburb-residential district	949	796
All independent dentists	1,056	796

Table 47 • Average number of patients of independent dentists in 1955, by age of dentist

Age of dentist	Mean no. of patients	Median no. of patients
25—29	669	496
30—34	992	800
35—39	1,163	897
40—44	1,183	898
45—49	1,235	901
50—54	1,190	852
55—59	1,175	625
60—64	783	505
65—69	699	500
70—	675	496
All ages	1,056	796

Table 48 • Average number of patients of independent dentists in 1955, by type of practice

Type of practice	Mean no. of patients	Median no. of patients
General practitioner	1,068	800
Specialist	940	404
Oral surgeon	2,130	1,494
Orthodontist	311	248
Pedodontist	*	*
Periodontist	*	*
Prosthodontist	*	*
All independent dentists	1,056	796

*Too few replies for reliable statistics.

Table 49 • Mean number of patients of independent dentists in 1955, by number of employees

No. of employees*	Mean no. of patients
0	704
.1— .4	805
.5—1.4	1,038
1.5—2.4	1,174
2.5—3.4	1,850
3.5 and more	2,430
All independent dentists	1,056

*Part-time employees and employees who did not work the full year were counted as fractions.

Table 50 • Mean number of patients of independent dentists in 1955, by number of dental chairs used

Number of chairs	Mean no. of patients
1	743
2	1,113
3	1,539
4 or more	1,698
All independent dentists	1,056

difference in number of patients between these two specialties was even greater in 1952, when the mean number of patients of oral surgeons was 2,858.

OTHER FACTORS

A large part of the total variation in number of patients is explained by the size of the office, that is, number of personnel employed and number of dental chairs (Tables 49 and 50). The mean number of patients increased from 704 for dentists with no employees to 2,430 for dentists with 3.5 or more employees. Approximately 2 per cent of the private practitioners responding had 3.5 or more employees.

Those self-employed dentists who were so busy during the year that they were unable to accommodate all would-be patients averaged 1,344 patients compared to 611 patients for the dentists who stated they did not have enough patients (Table 51). It is interesting to note that those dentists who had neither too many nor too few patients—those who indicated there was a "good balance" between demand for dental care and their ability to meet it—had fewer patients (1,029) than the over-all average (1,056).

Based on the mean of 1,056 patients reported by private practitioners in this survey, it is estimated that 73,000,000 persons, or 45 per cent of the civilian population, saw the dentist during 1955. These figures compare with estimates of 65,000,000 persons or 42 per cent in 1952, and 60,000,000 persons or 40 per cent in 1949.

The next article in this series will present information on length of wait for an appointment and a measure of dentist busyness.

BUREAU OF LIBRARY AND INDEXING SERVICE

The American Dental Association Film Library

The films, "Science Writers Get the Facts on Fluoridation," and "Dentistry for the Handicapped Child," are two of the films acquired since the publication of the supplement to the booklet, *Audio-Visual Materials in Dentistry*. The films can be rented for $2.50 each and both publications can be obtained free of charge from the Film Library, 222 E. Superior St., Chicago. The new supplement, in addition to listing and describing the films, filmstrips and slides acquired by the Film Library since 1954, contains information on materials and equipment suitable for the education of patients in a dental office.

FILM REVIEWS

Science Writers Get the Facts on Fluoridation • (Cleared for television.) 16 mm., black and white, sound, 14 minutes, 20 seconds. Produced in 1956 by the Committee to Protect Our Children's Teeth, N. Y. Technical production by Leo Trachtenberg Films, Inc. Available, free of charge, from U. S. Public Health Service offices. Can be purchased from George B. Schless & Co., 14 W. 55th St., New York 19, N. Y.

According to its producer, the purpose of this film is to give to a television audience or a community group a simple, understandable synopsis of the current status of water fluoridation. There are no special settings. This is actually a film record of a scientific press conference conducted by Dr. W. W. Bauer, director of health education of the American Medical Association in which Francis A. Arnold, director of the National Institute of Dental Research, is interviewed by science writers: John Troan, Pittsburgh Press, Earl Ubell, New York Herald Tribune, Gordon Bleasdell, Toronto Star, Ray Bruner, Toledo Blade, and Pierre Fraley, Philadelphia Bulletin. The questions cover the basic facts on fluoridation and fallacies and rumors regarding its safety are countered. In the final portion of the film the reporters comment on the status of fluoridation in their respective cities. This film, although it has technical shortcomings, will make suitable program material for dental societies in those communities which are considering fluoridation.

Dentistry for the Handicapped Child • (Cleared for television.) 16 mm., color, sound, 27 minutes. Produced in 1956 by Manuel W. Album, D.D.S. Sponsored by the Philadelphia Society for Crippled Children and Adults. Technical production by Bornman Productions, Philadelphia. Can be purchased from the producer, Medical Arts Bldg., Jenkintown, Pa. (Prints with Spanish sound tracks are also available for purchase.)

The purpose of this film, according to its producer and sponsor, is to help teach dentists how to treat handicapped children. The film opens with the school bus arriving at the school and discharging its passengers—children with cerebral palsy and other handicaps including those resulting from polio. The narrator says, "All of these children not only need proper dental care but also physical, speech and occupational therapy to prepare them for life."

In the dentist's office no medication is given on the child's first visit; the child merely is introduced to his new surroundings. The dentist is shown preparing a cavity under a local anesthetic. The narrator stresses the need for a steady hand to prevent any injury during the cerebral palsied child's movements. In one instance shown, the mother holds the child during the dental examination.

A special setup is arranged to make the treatment more comfortable for the patient and easier for the dentist. For severe cases a table is constructed over the dental chair to allow the patient to lie in a supine position. The child still rests his head on the dental chair head-rest, however. Dental work then proceeds in a normal fashion.

Premedication is indicated if the dentist finds it impossible to handle the patient under normal circumstances. In very difficult instances, general anesthesia may be necessary.

This film is well organized. It is suitable for postgraduate students and general practitioners, especially those interested in dentistry for children.

COUNCIL ON FEDERAL DENTAL SERVICES
COUNCIL ON DENTAL HEALTH
COUNCIL ON LEGISLATION
COUNCIL ON HOSPITAL DENTAL SERVICE

Recent developments in Defense Department's Dependents' Medical Care Program

The Council on Federal Dental Services on December 13, 1956, issued Special Bulletin No. 1, Dependents' Medical Care Act to constituent society secretaries and chairmen of constituent society military affairs committees (or society military affairs representatives). The Bulletin, which was published in THE JOURNAL for January 1957, page 86, called special attention to the dental aspects of the Dependents' Medical Care Program which became effective on December 7, 1956. It contained digests of the act and the directives and regulations related to the operation of the program.

On December 8, 1956, Harry Lyons, president of the American Dental Association, and members of the staff of the Association met with Major General Paul I. Robinson (M.C.), U. S. Army, executive director of the Office for Dependents' Medical Care, to discuss the dental aspects of the program. At the December meeting, Dr. Lyons presented the following formal statement of the American Dental Association dealing with the dental aspects of the Medicare Program:

EVALUATION OF THE DEPARTMENT OF DEFENSE MEDICARE PROGRAM

Under the criteria for determining eligibility of military dependents for health care from civilian facilities, it is reasonable to assume that the vast majority of patients will be wives and minor children of members of the uniformed services.

The benefits authorized under Section 5 of the Department of Defense directive specifically include:

1. Treatment for acute medical and surgical conditions, including exacerbations or acute complications of chronic diseases.

2. Dental care which is a necessary adjunct to medical or surgical treatment rendered in a hospital to a dependent who is a hospital inpatient. "Such dental care shall not include removable or fixed prosthodontic restorations."

3. Diagnostic tests and procedures, including laboratory and roentgenographic examinations while hospitalized, when ordered by the attending physician.

PRIMARY DENTAL CARE UNDER MEDICARE PROGRAM

As presently stated in the Department of Defense directive, section 501 i, Title II of the Medicare program excludes dental care except as a necessary adjunct to medical or surgical treatment.

Within the scope of dental practice and particularly hospital dental practice, there are dental disorders which can be properly classified as acute medical and surgical conditions, including acute exacerbations or acute complications of chronic diseases. This fact is recognized in most of the existing schedules of benefits and the fee schedules of Blue Cross, Blue Shield, and commercial insurance programs. In fact, diseases directly treated by dentists as part of their professional responsibility and within their particular professional competence are listed within the Department of Defense pamphlet (entitled *Nomenclature for Proposed Medical Charges).*

Examples of acute medical and surgical conditions which are accepted as within the purview of dental responsibility are:

1. Fractures of the maxilla and mandible.

2. Alveolar fractures and fractures of the teeth.

3. Dislocation of the temporomandibular articulation.

4. Oroantral fistulae and foreign bodies in the maxillary sinus.

5. Diagnostic and therapeutic nerve blocks of the inferior dental and facial nerves.

6. Management of cysts of the jaws.

7. Acute infections of the jaws.

8. Removal of impacted teeth.

In the management of such conditions in hospitals, the existing practice is for the patient to be admitted to the hospital by the cognizant staff dentist, for the dentist to assume primary responsibility for the treatment and for the dentist to discharge the patient at the completion of the treatment. When in the performance of his responsibility, the dentist requests medical consultation and cooperation, that medical support assumes the status of adjunct medical care.

It is essential, if treatment of these "acute medical and surgical conditions" of dental origin is to be provided to dependents, that the regulations governing the operation of the Medicare program be adjusted to permit the continuation of this well-established system of practice. Since Blue Cross, Blue Shield and commercial insurance companies are acting only as fiscal agents for the Department of Defense under the regulations established by the Department, and since the normal administrative mechanisms of these companies are not involved, there appears to be no reason why this adjustment cannot be made by the Department of Defense.

SUPPORTIVE DENTAL CARE

The second area in which Medicare may include dental health care benefits—where dental treatment is adjunct to the resolution of the primary condition for which the patient was admitted—has an established corollary in existing hospital practice also.

Where a physician feels that the dental health of the patient may be affecting the resolution of the problem under his management, or if he desires to rule out dental health as a contributing factor, the request for dental consultation and cooperation is a normal procedure. For example, the relationship between uncontrolled diabetes and periodontal infection is a recognized clinical fact. In the management of the diabetic patient, the physician routinely requests an evaluation of the dental health of the patient in order that any advanced periodontal infection, which is a common sequel in diabetes, may be eliminated and controlled in the interest of removing the burden which that infection places on the already reduced resistance of the patient. In such a case, the dentist is called in for consultation and decides what, if any, measures are needed to bring the periodontal problem under control.

In the management of cleft palate problems, the team approach involving the combined skills of the pediatrician, the surgeon, and the dentist is well established. No matter what the individual condition might require in its immediate management, moreover, the long-term success of the rehabilitation requires that specific emphasis be placed on the dental health of the individual, so that a sound base may be provided for any prosthetic device required to re-establish oral function. In none of the decisions involved in the successful management of cleft palate problems does one particular skill necessarily predominate in importance. Rather they are all adjunctive to the successful end result.

Although there is no provision in the Medicare program for comprehensive health care, either medical or dental, the individual episodes of dental health care as an adjunct to medical care may take the form of any one or more of the items which comprise the full scope of dental health care. This fact will necessitate the negotiation of a comprehensive fee schedule for dental services, and such fee schedules should be negotiated with the several state dental societies.

The directive and joint regulations should define "adjunct dental care" to reflect the physician and dentist joining in a supportive effort in the solution of the primary cause of hospitalization and treatment. The scope of adjunct dental care for any one treatment episode should be limited to that care required for treatment of the specific condition for which the patient is hospitalized, as are the hospitalization and the medical and surgical care.

OUTPATIENT CARE

The third area of potential conflict with established dental practice in the hospital involves the provisions of the Medicare program dealing with the use of outpatient facilities of the hospital for the management of traumatic episodes which may or may not result in hospitalization.

These benefits include: Use of hospital outpatient facilities for the treatment of fractures, dislocations, lacerations and other wounds when the patient is not hospitalized and when authorized by the attending physician. (In connection with such use, a maximum of $75 is allowed for laboratory tests, pathology and roentgenographic examinations.)

Children are particularly prone to traumatic accidents. In such instances it is usual practice to take the injured child directly to the emergency outpatient facility of the hospital. Although many of these problems involve both medical and dental care and require that the dental care be coordinated with the general medical rationale, a great many of these accidents are limited to injuries of the mouth and jaws. These regions are totally within the purview of dental management and are completely dependent on dental judgment and decision.

An example is the common skating accident which results in injuries to the mouth tissues, all of which injuries are properly treated by the dentist. The injury may include abrasion of the soft tissues, fracture of the teeth with or without pulp involvement, fractures of the alveolar bone which supports the teeth or fractures of the mandible or maxilla.

If these dental services are to be provided under Title II of the Medicare program, the directive and joint regulations should specify that such dental care is authorized for dependents and that payment will be made directly to the dentist under the same conditions that govern payments to physicians.

SUMMARY

It is understood that any dental care provided under Title II of the Medicare program must be validated before payment will be authorized to the dentist. There is, however, no justification for establishing within the Medicare program, through directives, regulations, contracts or otherwise, the principle that dental care, whether primary or supportive, may be provided only by prescription and certification of a physician.

Where the condition to be treated is primarily medical it would, of course, be necessary for the physician to certify to the fiscal agent the need for any supportive dental treatment. That certification would, however, take place after the cognizant dentist has joined with the physician in the professional determination of the need, if any, for supportive dental care.

Where the patient's condition is primarily dental, however, there should be no requirement of a physician's certification to permit the dependent to obtain government financing of any primary dental care and related hospitalization benefits to which he is entitled. Whether the role of the dentist is primary or supportive, moreover, there should be a method for making direct payment to the dentist for the services he renders.

It seems reasonable to expect, furthermore, that the payment of civilian dentists for every type of service rendered under Title II of the Medicare program be in accordance with a fee schedule negotiated by the Department of Defense directly with state dental associations.

Since the December 8 meeting with General Robinson, the Association has continued its efforts to bring about a readjustment of the Medicare program and the implementing joint directives and regulations in conformity with Association policy and the established concepts of dental practice. Since representatives of the dental profession were not consulted at the time that the Medicare directives and regulations were established, the administration of dental aspects of the Medicare program under the present directives and regulations has resulted in considerable confusion as to authorization of dental treatment, particularly in the matter of validation of treatment by a physician and the method of billing by dentists. This confusion was highlighted in a letter dated March 15, 1957, addressed to the Association's Council on Federal Dental Services by Lt. Col. Robert W. Hobson, D. C., U. S. Army, Special Assistant for Dental Affairs in the Office for Dependents' Medical Care. Excerpts from Colonel Hobson's letter follow:

To date seventeen specific dental claims and ten claims for administering the anesthetic, laboratory workup, etc., have been received. Of these seventeen claims, two have been approved for payment, five disapproved and ten are being held in abeyance awaiting further information on which to base a fair and just decision. In all cases where the dental claim has been disapproved for payment, the claim for administering anesthetic, laboratory workup, etc., has also been disapproved.

Without exception each of the dental claims has presented a distinct and separate problem. These problems have apparently arisen because of misunderstanding or lack of information concerning the conditions under which dental care is authorized, and the type of dental care authorized in civilian facilities under the Dependents' Medical Care Program.

To assist in clarifying the conditions under which dental care is authorized in civilian fa-

cilities under the Program, I would like to bring to your attention the pertinent passages of the Joint Directive For Implementation of the Dependents' Medical Care Act (P. L. 569—84th Congress) that pertain to and are associated with dental care.

1. "Dental care which is a necessary adjunct to medical or surgical treatment rendered in a hospital to a dependent who is a *hospital inpatient. Such dental care shall not include removable or fixed prosthodontic restorations.* (Italics supplied.)

2. "Dental Care as a Necessary Adjunct to Medical or Surgical Treatment. Dental care determined by the cognizant physician and dentist to be required for the proper treatment of a medical or surgical condition.

3. "Terms of Reference and Rules for the Provision of Authorized Medical Care From Civilian Sources. Physician or Surgeon. A person who is legally qualified to prescribe and administer all drugs and to perform all surgical procedures.

4. "Professional Services Related to Hospitalization. The payment of physicians' fees according to the local schedule of allowances, *including those of necessary consultants,* for treatment of medical and surgical conditions during a period of hospitalization is authorized. The attending physician shall certify as to the requirement for a consultant's services." (Italics supplied.)

From the preceding quotations taken from the Joint Directive a criteria has been established for the evaluation of dental claims that arise in civilian facilities under the Dependents' Medical Care Program. The criteria for approval of a dental claim is as follows:

1. There must be an attending or charge physician who has hospitalized the patient for a medical or surgical condition requiring hospitalization.

2. The dental care determined necessary by the physician and dentist must be adjunctive to the medical or surgical condition for which the patient was hospitalized.

3. The adjunctive dental care is rendered while the patient is a hospital inpatient.

4. Such dental care shall not include removable or fixed prosthodontic restorations.

5. There are no provisions for routine or elective dental care in civilian facilities under the Dependents' Medical Care Program either on an inpatient or outpatient basis.

I believe that it would be of further assistance in understanding the dental aspects of the Medical Care Program to cite two cases as illustrations.

Dependent A had been suffering with severe headaches for a period of time. She was receiving care from a physician on an outpatient basis. During the course of treatment she was referred by the physician to the dentist for a dental examination. The dental examination revealed the presence of four impacted third molars. It was determined by the physician and dentist that the removal of these impacted teeth might prove beneficial to the patient. The dentist hospitalized the patient and the four teeth were surgically removed. Based on the facts given this claim is not allowable for the following reasons:

1. The dental care was not adjunctive to a medical or surgical condition *which required hospitalization and for which the patient had been hospitalized.* She had received medical care from the physician on an outpatient basis, which does not come under the Program.

2. There was no attending or charge physician who hospitalized the patient for a medical condition requiring hospitalization.

3. Under the terms of reference there are no provisions for the dentist to authorize care.

Dependent B went to her physician because of a massive swelling of the neck and jaw. The physician hospitalized the patient with a diagnosis of cellulitis. During the course of treatment he requested a dentist to examine the patient. The dentist found that the lower first and second molars were abscessed. The physician and dentist determined that the extraction of these two teeth and the establishment of drainage would be beneficial to the treatment of the condition for which the patient had been hospitalized. The teeth were extracted, drainage was established and with supportive care the patient recovered.

This case meets all the criteria for adjunctive dental care and has been paid.

The Councils submitting this report call the attention of dentists who are rendering care to military dependents to the fact that until the desired changes in the Medicare directives and regulations can be effected, the Office for Dependents' Medical Care has no other recourse in the payment of dental claims except to follow the stipulations of the present directives and regulations.

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Editorials

Voluntary pension plans for dentists

In 1956 Congress amended the Social Security Act to include dentists on a mandatory basis. This year for the first time dentists began paying into the Social Security fund. As is well known, the most that a dentist with no dependents can receive on retirement at age 65 is $108.50 a month—hardly enough to provide the abundant life, and hardly a solution to the economic problems of old age and retirement.

Realizing this fact and aware of the inequities in existing retirement plans which are inimical to the best interest of dentistry, the House of Delegates of the Association as early as 1953 resolved to seek legislation which would offer to dentists an opportunity to establish a retirement income plan for themselves, under the same tax equities provided for the beneficiaries of company sponsored plans.

Such legislation, H.R. 9 and 10, known as the Jenkins-Keogh bill, has been introduced in the current session of Congress. The present Jenkins-Keogh bill is a refinement of similar bills that have been before Congress for the past half dozen years or more. It is one of a dozen similar measures introduced up to February 10. The purpose of the Jenkins-Keogh bill is to establish for self-employed persons—dentists, physicians, lawyers and other professional persons—an opportunity to build up savings toward their retirement in a manner similar to that now available to employed persons benefiting from company retirement programs. Under the provisions of the Internal Revenue Code, a corporate employee covered by an approved pension plan is not required to pay income tax on the employer's contributions to his pension fund until after the employee begins to receive his pension benefits. Thus the employee, during his years of highest earnings, is permitted to declare part of his income as nontaxable. That income does become taxable later, but at a time when the employee is likely to have much lower earnings.

The Jenkins-Keogh bill would permit self-employed persons to defer the payment of income tax on the yearly amounts those persons contribute to approved retirement funds or toward the purchase of approved annuity contracts. The amount that a self-employed person could deduct annually would be limited to 10 per cent of gross income up to an annual maximum of $5,000. The amount invested with accumulated earnings would become taxable as the yearly withdrawals were made after the person reached age 65. Withdrawals before age 65 would be permitted only on a showing of total and permanent disability.

Congressman Keogh explains that the bill would encourage the self-employed —including the dentist, the physician and the lawyer—to provide for the cost of old age, thereby relieving the federal, state and local government of much of this responsibility.

When enacted, the measure would correct an existing serious inequity—one created by the fact that the large group of self-employed persons is now prevented from establishing retirement savings programs that will permit the same tax advantages that are extended to employees under qualified plans established by their employer.

The fairness of the Jenkins-Keogh proposal has been proved by irrefutable evidence. The principle of the bill has gained the endorsement of both political parties and of the President. Similar legislation for self-employed persons already has been adopted by the government of Great Britain and is now in effect.

Congressional observers believe that there is an excellent chance that Congress will approve the Jenkins-Keogh proposal during this Congress and thus end the discrimination against self-employed persons. Already a large number of constituent and component dental societies have adopted resolutions supporting the principles of the Jenkins-Keogh bill.

It is recommended that every dentist interested in the opportunity to establish a retirement income plan for himself under the same tax equities provided for employed persons write his Congressman, urging support for the Jenkins-Keogh bill, H.R. 9 and 10.

President Lyons reports on fluoridation

Argument on fluoridation continues to assail the public despite overwhelming evidence of its safety and effectiveness. Such evidence has been provided by several American communities which, some twelve years ago, decided to fluoridate their public water supplies. During the last decade approximately 1,500 other communities in the United States decided to do likewise. Their action is in keeping with the profession's belief that the decision on fluoridation is a matter of local responsibility. The dental profession, however, has the obligation of providing information to make it possible for communities to reach a decision on the basis of scientific evidence rather than on a basis of emotional or political prejudice.

An excellent example of informing the public is provided in an article on fluoridation by Harry Lyons, president of the American Dental Association. The article is to appear in the May 12 issue of *Parade*, a weekly magazine supplement of 55 metro-

politan newspapers throughout the United States. Their combined circulations are 7,200,000. The article is designed for the average newspaper reader and presents in clear-cut terms a discussion of "What You Should Know About Fluoridation." The article is commended to members of the profession as an example of good public relations.

Youth, dentistry and the National Science Club program

This month Los Angeles is the site of the Eighth National Science Fair. From the ninth to the eleventh inclusive, that southern California city will be host to some 350 high school boys and girls—this year's winners in their local and regional science club contests. The annual Science Fair and the Science Club program which it represents are most important to dentistry because of their direct and indirect influence on the future of dental research and on the future practice of dentistry.

The nation-wide Science Club program is sponsored by Science Service, a national nonprofit institution for the popularization of science. The program is supported by educational, industrial and professional organizations, and is designed to stimulate junior and senior high school pupils to increase their interest in science with the ultimate aim of increasing both the quality and quantity of tomorrow's research workers. Some 15,000 clubs, boasting an enrollment of a third of a million members, are now in operation in the nation's secondary schools. Outside encouragement and material assistance are provided by individuals, newspapers, professional and industrial representatives and agencies. Each youngster is encouraged to develop an exhibit of some scientific project or subject which is displayed and judged at a local Science Fair.

The winners then compete at Regional Fairs. Two winners from each of the Regional Fairs then enter the final contest at the National Science Fair. This is the contest being held in Los Angeles this month. The intrinsic value of the prizes awarded the winning exhibits in the two major categories—biological sciences and physical sciences—is nominal. Of far greater value is the stimulus provided the contestants and the encouragement given them to enter some branch of scientific endeavor. Some of that encouragement should be in the direction of the health sciences, and particularly in those pertaining to dentistry, as the health professions must not lose out to industry in the growing competition for scientific brains.

Such competition grows greater with each passing year. It is safe to say that since World War II not a day has passed but that the need for more scientists, researchers and engineers has been called to the attention of the nation. Some contend that industry, recognizing this need early, has outdistanced the health professions in attracting more of the more capable neophyte scientists. Whether that is true is debatable. It is not debatable that industry early saw the potentials in the science clubs program and aided in the establishment of such clubs and in the development of their activities. Quite possibly such aid and interest rebounded to the benefit of in-

dustry by increasing its recruitment of budding scientists. Medicine has more recently realized the possibilities in this program and through its state and county societies has aided in its development. Unquestionably such aid will attract more keen-minded young men and women to the medical profession.

The nation-wide Science Club program offers to dentistry the same opportunity it offers industry, medicine and the other health occupations. Since the Science Club program is basically a grass roots program, local dental societies and state dental societies are urged to investigate the possibility of cooperating with their local clubs. Not to do so is to miss a great opportunity to aid the youth of their community and the future of the profession.

Latest in dentifrice advance: recorded by the cartoonist

"This X97 ingredient is the best yet—it's habit-forming."

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International Correspondence

NEWS FROM GREAT BRITAIN

The March 5th issue of the *British Dental Journal* deals in its editorial with possible hazards of radiation. The magazine contains an original article on radiation hazards in dental roentgenology by Drs. Blackman and Greening and publishes also a statement by the United Nations Scientific Committee on the effect of atomic radiation entitled "The Responsibilities of the Medical Profession in the Use of X-rays and Other Ionising Radiation." These statements should be studied by all dentists, and it is hoped that the fullest cooperation will be given to the United Nations' appeal to collect information on the use of the roentgen ray.

DENTAL LAWS

A bill to consolidate all the laws relating to dentistry was presented to the House of Lords on February 5. When this bill becomes law it will involve the repeal of the whole or greater parts of the Dentists' Acts of 1878, 1921, 1923 and 1956. When consolidating in this way, Parliament has the power to make corrections and minor improvements to the existing law, but this is the extent of the power to alter the law as it appears in the earlier Acts. The council of the British Dental Association has scrutinized the new bill. It is satisfied that the measure does, in fact, reproduce the existing law and that alterations to be made on consolidation are of little importance to the profession.

NATIONAL HEALTH SERVICE

On February 20, the Prime Minister, making a statement on the remuneration of physicians and dentists in the National Health Service, announced the setting up of a royal commission to review medical and dental remunerations through an independent enquiry which would take into account the position of the medical and dental professions in relation to other professional classes in the community and would suggest how the matter could be kept under review.

A revised scale of fees for the general practitioner in the Health Service has been agreed on by the British Dental Association and the Minister of Health and will be introduced April 1. It is believed that the new scale is the best that could be achieved within the limitations imposed by the agreement made with the Minister of Health in May 1955. Owing to the tenacity of the Association negotiators, the denture fee remains unchanged; there is, however, a small reduction in the repairs fee.

Fees for extraction have been improved slightly. The fee for extracting one tooth and that for extracting two teeth will no longer be the same. Recognition is given to the added time and labor involved in extracting teeth in different quadrants of the mouth. Fees for metal dentures show a modest improvement.

Fees for filling teeth in adult patients have not been altered greatly, but there is a novel feature in the introduction of a fee for what are termed confluent compound fillings, that is, the filling of MOD and similar cavities. This position will be an improvement on that which obtained previously, but it is problematical whether there will be any over-all financial benefit from conservative work on teeth of adults because there is to be an over-all limit per tooth.

The other significant feature of the scale concerns children's dentistry, for which there is a special section instead of the one item in the existing scale. The changes should encourage conservative work on deciduous teeth (something which the Ministry strongly favors), although the improvements in the scale are not of the order they might have been had there been no over-all financial limitations.

ROYAL COLLEGE OF SURGEONS

Prof. James Aitchison and David Middleton have retired after three years of valuable service on the dental council of the Royal College of Surgeons of Edinburgh and their places have been taken by John Campbell and William D. MacLenan.

During the year, nine of 20 candidates were successful in the primary fellowship examination, and five of nine candidates passed the final fellowship examination and were subsequently elected Fellows in Dental Surgery.

Menzies Campbell has made a gift to the College of manuscript notes made by John Smith.

Warmest congratulations were offered to

the president, Sir Walter Mercer, for the knighthood conferred by Her Majesty the Queen.

ITEMS OF INTEREST

Already 62 cars with 165 passengers are enrolled for the Twelfth International Dental Congress motor tour organized by Denis Reid. An extensive motor coach trip is planned also. The attendance of British dentists and their families at the international meeting to be held in Rome September 7-14 will undoubtedly exceed all records for a meeting outside the United Kingdom.

Newcastle-on-Tyne July 1-5 are the place and dates of the annual conference of the British Dental Association. The program is published in the February 19 issue of the *Journal*. Four main papers, scientific and clinical demonstrations, films and a full social program are planned. Visitors from abroad will be welcome.

In the 1956-57 school year the number of students in English dental schools who came from the Commonwealth and foreign countries was 109 and 113, respectively. The number of students who started the first year of their professional course at English dental schools this year was 509. In 1955-56 it was 495, and in 1954-55, the year previous, it was 381.

The British Society for the Study of Periodontology had its February meeting at the Eastman Dental Hospital. One of the younger members, S. R. Trott, presented an original paper entitled, "An Investigation into the Glycogen Content of the Gingivae." W. G. Cross gave a short paper on "The Fate of A Bone Implant."

The American Dental Society of London held a successful clinical meeting in March at Guy's Hospital Dental School, followed by a well attended dinner at which the guest speaker was Lord Moran.

G. H. Leatherman,
D.M.D., F.D.S., R.C.S., F.A.C.D.

TRUSTEES ENDORSE JOINT ACTION FOR PASSAGE OF PENSION PLAN BILLS; VOTE FUNDS FOR RADIATION BOOK

Association membership in the American Thrift Assembly, an organization promoting retirement plan legislation for the self-employed, has been approved by the Board of Trustees of the American Dental Association. The Board met March 28-30 at the Central Office. The Board also:

1. Reviewed activities in the field of laboratory relations.
2. Voted $2,500 towards the cost of publishing a booklet on radiation hazards.
3. Appropriated $4,500 to evaluate the ILWU-PMA children's dental care program, and $500 for a project to aid state dental societies in negotiating fees under the government's Medicare program.
4. Approved a guiding statement on TV and radio appearances for dentists.
5. Endorsed the appointment of Arthur S. Flemming, president of Ohio Wesleyan College, to head the Commission for the Survey of Dentistry.
6. Approved the appointment of section officers for 1958.

LABORATORY RELATIONS

The Trustees voted to file a statement with the Federal Trade Commission requesting that the term "articulation" not be included in the *Trade Practice Rules for the Commercial Dental Laboratory*. If the term is included, the Board stated, it should be modified by the term "mechanical."

A resolution of the New Jersey State Dental Society to rescind all actions on the "training of dental technicians at several levels, including the vocational, in accredited dental schools" was sent by the Board to the House of Delegates with the comment that, if passed, the resolution will deprive the Association of its rights and interests in the training of technicians. Additionally, the Board pointed out, it will automatically nullify the certification program for technicians authorized by the House last fall.

A proposal to study possible affiliation of dental auxiliaries with the American Dental Association was referred to the Council on Dental Education.

RETIREMENT PLANS

Floyd W. Pillars, vice-chairman of the Council on Legislation, will represent the American Dental Association in the newly-formed American Thrift Assembly, the Trustees decided.

The American Thrift Assembly, established by the American Bar Association and 13 other groups representing the self-employed, will press passage of the Jenkins-Keogh bills in Congress. These measures, long supported by dentistry, would allow self-employed persons to defer tax payments on a certain portion of their income set aside for retirement purposes. Taxes would be paid at the time the pension was received. The measures have been before Congress for nearly a decade, and it is felt that coordinated action by organizations of the self-employed will be important in achieving passage. Some ten million persons would benefit by the measures.

RADIATION BOOKLET

A grant up to $2,500 to the American College of Radiology to help publish a book on radiation hazards was approved by the Board. When published, the book-

let will go to all A.D.A. members, all physicians on the American Medical Association's mailing list, to the osteopaths and to veterinarians. Additionally, copies will be distributed through other health organizations. About 400,000 copies are needed, and the estimated cost (funds to be contributed by a number of organizations) will be $25,000.

MEDICARE SURVEY

The Board made two appropriations for projects of the Bureau of Economic Research and Statistics.

The first is for printing dental fee survey questionnaires to be distributed by the Bureau to state and local dental societies. With the establishment of the Defense Department's medical care program for dependents of servicemen (Medicare), it has become necessary for state societies to negotiate fee schedules with the Department of Defense. In preparation, many societies are carrying out fee surveys, and revised questionnaires are needed.

The second appropriation will be used by the Bureau for a study of the first year's operation of the children's dental health care programs operated by the ILWU-PMA welfare fund on the West Coast. Tabulation of data from the more than 100,000 punch cards bought from the welfare fund is expected to make available statistics on the dental needs of large groups of children, information required by dental societies in dealing with requests for group dental health care plans.

INSURANCE PROGRAM

Two improvements in the Group Health and Accident Insurance Program were endorsed by the Association. The first extends the period of grace for the payment of premiums from ten to 31 days. The second extends the accidental death and dismemberment benefits so that the certificate holder may elect either to collect the lump sum dismemberment benefits or to receive monthly indemnity payments for the period of disablement up to five years. There is no additional cost to the policy holder for these benefits. It was reported to the Board that more than 31,000 Association members are now covered by the health and accident program.

ANNUAL SESSION

Philadelphia was chosen for the site of the 1961 annual session. The Association met there last in 1926.

Plans were approved for the 1957 meeting to be held in Miami Beach, Fla., November 4-7. Bus service from the Miami Beach hotels, where most convention visitors will stay, to the Dinner Key Auditorium, site of the scientific session and exhibits, will be subsidized by the Association, the Trustees decided. The subsidy will make possible a bus fare of 50 cents, thus saving time and money for convention visitors.

Members of the local arrangements committee, under the chairmanship of Arthur W. Kellner of Hollywood, Fla., approved by the Board are:

Honorary Officers • Brant S. Carroll, William W. Mitchell, Olin G. McKenzie, George A. Stampelos.

Vice-Chairmen • Joseph A. Bullock, Glenn C. Van Camp, Horace W. Stubbs, Meyer Eggnatz.

Clinics and Motion Pictures • Alvin D. Farver, chairman; James L. Armstrong, vice-chairman; James W. Cosper, Jr., J. Murray Cox, William H. Fountain, Anthony R. Joffre, Robert L. Kaplan, Herbert I. Kendrick, Franklin M. Kenward, Richard L. Mathewson, C. Dade Pearson, H. Roger Turner.

Entertainment and Social Events • Curtis A. Haggard, chairman; Charles L. Craig, vice-chairman; Edward H. Arnold, Jack H. Beckwith, William F. Briggle, Robert L. Cherry, Fred W. Crockett, Jr., James L. Hester (deceased), Louis F. Jourdain, Melvin E. Patton.

Information Services • George J. Coleman, chairman; John P. Miles, vice-chairman; Roy T. Bovard, Frederick E. Hasty, Jr., Howard F. Hewett, Edward V. Petrow, D. Frank Rentz, Richard T. Simpson, Gideon J. Stocks, Jr., Leonard S. Turner.

Publicity • Ernest B. Penn, chairman; Mr. Lyman O. Pickett, vice-chairman; Henry J. Biosca, William R. Edwards, Irving Gordon, S. Hill Gordon, Blair C. Madsen, Thomas A. Price, Henry Renedo, Jr., Albert E. Rosenthal.

Women's Entertainment • Mrs. Charles L. Craig, chairman; Mrs. George J. Coleman, vice-chairman; Mrs. William H. Fountain, entertainment; Mrs. William F. Briggle, hospitality; Mrs. Curtis A. Haggard, preconvention activity.

It was reported that on the basis of December 31, 1956, membership figures, the state societies of Delaware, Illinois and Nebraska will have one less delegate each in the 416-member House this year, while Florida, Michigan and California will each have one more. Representation of a state society in the House is based on its percentage of the total Association membership.

SECTION OFFICERS

To aid in preparation of the scientific session at annual meetings, the Association has 12 sections, representing different areas of dental practice, and presided over by section officers. At the March meeting the Board approved vice-chairmen for three sections for the current year to replace men who were unable to serve. It also appointed 1958 officers.

Approved as vice-chairman for 1957 were: Jerry A. Millhon of Springfield, Ill., section on anesthesiology; Kenneth P. Ramsay of Beverly Hills, Calif., complete prosthodontics, and George E. Emig of Washington, D. C., partial prosthodontics. Approved for 1958 were:

Anesthesiology • Jerry A. Millhon of Springfield, Ill., chairman; Daniel F. Lynch of Washington, D. C., vice-chairman.

Operative Dentistry • Roger E. Sturdevant of Chapel Hill, N. C., chairman; Robert F. Eastman of New Orleans, vice-chairman.

Oral Surgery • Don H. Bellinger of Saginaw, Mich., chairman; Carl J. Reimer of Sacramento, Calif., vice-chairman.

Orthodontics and Oral Development • William R. Humphrey of Denver, chairman; William R. Root of Buffalo, vice-chairman.

Pedodontics • Francis W. Summers of Los Angeles, chairman; Kenneth E. Lawrence of Kansas City, Mo., vice-chairman.

Periodontics • Erwin M. Schaffer of Minneapolis, chairman; Delbert P. Nachazel of Milwaukee, vice-chairman.

Practice Administration • Jay H. Eshleman of Philadelphia, chairman; William R. Mann of Ann Arbor, Mich., vice-chairman.

Complete Prosthodontics • K. Paul Ramsay of Beverly Hills, Calif., chairman; Frederick N. Harris of Pasadena, Calif., vice-chairman.

Partial Prosthodontics • George E. Emig of Washington, D. C., chairman; John D. Adams of St. Louis, vice-chairman.

Public Health Dentistry • David F. Striffler of Santa Fe, N. Mex., chairman; Maurice J. Friedman of Little Rock, vice-chairman.

Research • David B. Scott of Bethesda, Md., chairman; Joseph C. Muhler of Indianapolis, vice-chairman.

Roentgenology • Arthur H. Wuehrmann of Birmingham, Ala., chairman; Harrison M. Berry of Philadelphia, vice-chairman.

RADIO AND TV ETHICS

A statement of guiding principles for dentists appearing on radio and TV programs was drawn up by the Bureau of Public Information and the Judicial Council and approved by the Board for submission to the House of Delegates.

It provides that dental societies may sponsor public service programs where the script and props have been approved in advance by the society. Commercial sponsorship is allowed provided that the

advertising, in general, is institutional in nature, and that no endorsement of the product by the society is implied.

Individual dentists should clear their appearance and program with the dental society, the guiding statement says. The society should limit the number of appearances a year to be made by any dentist. The dentist may use his name and title in the program, but no reference to his address or field of practice may be made. The full statement will be published in THE JOURNAL.

OTHER ACTIONS

In another action, the Board approved an increase in the subscription price for the JOURNAL OF ORAL SURGERY. The specialty journal, which will sell for $10 instead of $8 in the United States, and for $12 abroad, will appear six times a year instead of four, beginning in 1958.

Also approved was an appropriation to print a second edition of the Council on Journalism's *Rates and Data Handbook,* which provides information to prospective advertisers in state journals. The handbook will be sent to about 400 potential advertisers.

A contribution of $450 to the Austrian Federation of Dental and Medical Societies for relief of refugees from Hungary was approved.

In reviewing the report of the Council on Dental Therapeutics, the Board commented favorably on two resolutions of the Council. The first, which warns of the danger of viral hepatitis, says in part:

> The Council on Dental Therapeutics suggests that, whenever possible, instruments which may penetrate the soft tissues should be sterilized by exposure in the autoclave to saturated steam at 121°C. for ten minutes or by exposure to dry heat at a temperature of 160°C. (320°F.) for one hour, and strongly urges that the minimum treatment for disinfection of these penetrating instruments should be exposure to boiling water (100°C.) for 15 minutes. . . .
>
> The Council strongly discourages the use of chemical solutions for the disinfection of dental instruments which might be contaminated with the hepatitis virus since there is no evidence that these chemicals will destroy the virus.

The second resolution pointed to the relatively greater toxicity of local anesthetic agents when accidentally administered intravenously and said:

> The Council on Dental Therapeutics urges the practice of aspiration routinely before the injection of local anesthetics in order to determine that the needle has not entered a blood vessel. The Council believes (1) that with equipment presently available, aspiration may be accomplished most effectively by employing a glass syringe (Luer type); (2) that if this type of syringe cannot be used, then one of the aspirating type of cartridge syringes should be substituted, and (3) that because it is difficult to aspirate blood through needles of small lumen, the injection needle should not be smaller than 25 gauge.

Officers attending the spring meeting were: Harry Lyons, president; William R. Alstadt, president-elect; Eugene R. Westcott, first vice-president; Harold E. Cafferata, second vice-president; John W. Knutson, third vice-president; Gerald D. Timmons, speaker; Harold Hillenbrand, secretary; C. Willard Camalier, assistant secretary; Louis M. Cruttenden, assistant secretary; H. B. Washburn, treasurer, and Lon W. Morrey, editor.

Trustees at the meeting were: Arthur W. Easton; First District; Percy T. Phillips, Second District; Charles H. Patton, Third District; Edward R. White, Fourth District; Howard B. Higgins, Fifth District; Earl G. Jones, Seventh District; Robert J. Wells, Eighth District; Paul H. Jeserich, Ninth District; Lewis W. Thom, Tenth District; Clarence S. Renouard, Eleventh District; Harold M. Flickinger, Twelfth District, and John R. Abel, Thirteenth District.

A. F. Schopper, Sixth District Trustee, was unable to attend the meeting because of serious illness in his family. B. Bates Hamilton of Richmond, Mo., president-elect of the Missouri State Dental Association, attended for Dr. Schopper.

The American Dental Association's Central Office building has won an honor award for excellence in architecture from the Chicago Chapter of the American Institute of Architects and the Chicago Association of Commerce and Industry. John J. Hollister (center), Association business manager, received the plaque at a civic awards luncheon April 10. With him are Mr. Joseph L. Block (left), president of the Chicago Association of Commerce and Industry, and Mr. Samuel A. Lichtmann, president of the Chicago chapter, American Institute of Architects. The award was made to the Association and to the Association's architects, Childs & Smith, and contractor Gerhardt F. Meyne Co.

FIVE RESEARCH GRANTS APPROVED FOR ASSOCIATION

Five research project grants totaling $63,298 have been awarded American Dental Association scientists by the U. S. Public Health Service. The grants, made as part of the National Institute of Dental Research extramural program, are the first to go to Association employees under that program.

The projects range from two to five years in length. Grants are for the first year, but further support is usually automatic, assuming Congress provides funds.

One study will be carried on in the chemical laboratory at the Central Office and four at the Association's research fellowship at the National Bureau of Standards in Washington, D. C.

The project to be conducted at the Central Office is entitled "Enzymatic Degradation of Dental Local Anesthetics." The grant, to J. Roy Doty, secretary of the Council on Dental Thera-

peutics, is for $16,663. A four year study, it will investigate the rate at which local anesthetic drugs are destroyed by the blood and liver and by the oral tissues into which they may be injected. It is expected to provide additional information on the range of safe use of the drugs and perhaps the relative period of anesthesia induced.

The other grants and scientists to whom they were made are: evaluation of resin denture base materials (a two year study), George C. Paffenbarger, A.D.A. senior research associate, $15,725; fluorescence of hard tooth tissue (five year study), Alphonse F. Forziati, $14,600; properties of human enamel and dentin in compression (two year study), Mr. John W. Stanford, $11,402, and synthesis of a silica-resin direct filling material (three year study), Ray L. Bowen, $4,908.

A.D.A.-N.A.D.L. MAY CONFERENCE TO REVIEW COMMITTEES' WORK

A conference of representatives of the American Dental Association and National Association of Dental Laboratories has been scheduled for Chicago May 10 and 11. The third conference to be held by the two organizations this year, it will consider reports of joint committees working on technical aspects of a proposed program for the certification of dental laboratory technicians. The committees were set up at an A.D.A.-N.A.D.L. conference in Washington, D. C., in March.

PRESIDENT OF OHIO WESLEYAN TO HEAD DENTISTRY SURVEY

Arthur S. Flemming, president of Ohio Wesleyan University and recently resigned director of the Office of Defense Mobilization, has agreed to accept the chairmanship of the Commission on the Survey of Dentistry.

The survey, being undertaken by the American Council on Education at the request of the American Dental Association, will be a comprehensive study of the entire field of dentistry, its achievements, resources and areas for further development.

Dr. Flemming is known as an able administrator with special talent as an organizer of new projects. During the second world war, he held a variety of government posts, including chief of labor supply, labor division of the Office of Production Management; member of the Manpower Survey Board of the Navy Department, and member of the War Manpower Commission.

Additionally, he was a member of the advisory council of the Retraining and Reemployment Administration, Department of Labor, from 1944 to 1947, a member of the U. S. Civil Service Commission from 1939 to 1948, and a member of the Commission on Organization of the Executive Branch of the Government (Hoover Commission).

In the field of education, Dr. Flemming has had an equally distinguished career. Beginning as an instructor in government at American University in 1927, he rose to become director of the University's School of Public Affairs in 1934. He has been president of Ohio Wesleyan since 1948.

Five schools have awarded degrees to Dr. Flemming. He holds the A.B. and LL.D. degrees from Ohio Wesleyan, A.M. and LL.D. degrees from American University, the LL.B. from George Washington University, and the LL.D. degree from Temple University and Oberlin College.

RELIEF FUND AT $126,046 WITH TEN WEEKS TO GO

Contributions to the Golden Anniversary Relief Fund Drive reached $126,046.59 April 18, with a little more than ten weeks left in the drive. The current campaign ends June 30.

HOUSING BUREAU OPENS MAY 1 FOR MIAMI ANNUAL SESSION

Opening on May 1 of the American Dental Association's Housing Bureau for the 98th annual session has been announced by Arthur W. Kellner, chairman of the general committee on local arrangements. The annual meeting will be held November 4-7 in Miami and Miami Beach, and all reservations must be made through the Housing Bureau. Address of the Bureau is Box 1511, Miami Beach, Fla.

Some 40 hotels in this resort area, many of them world known, have pledged accommodations for the dental meeting. The hotels are in Miami, Miami Beach and Bal Harbour, the last a new section just north of Miami Beach.

A map showing locations of the three areas together with the official application form for hotel reservations appears on pages A-38 and 39 of THE JOURNAL.

The scientific program will be presented at Dinner Key Auditorium in Miami. The House of Delegates meets at the Fontainebleau in Miami Beach. More than 25 organizations in the dental field have scheduled preconvention meetings. Special bus service has been arranged between the Dinner Key Auditorium in Miami and major hotels in Miami Beach.

DENTAL PROCEDURES TO BE SHOWN BY COLOR TV IN MIAMI

Operative procedures at Florida's famed Dade County Dental Research Clinic will be viewed by audiences at Miami's Dinner Key auditorium via the television screen this November. Color television clinics are to be a feature of the scientific session of the American Dental Association's annual meeting in Miami

MEETINGS OF DENTAL ORGANIZATIONS IN MIAMI-MIAMI BEACH

American Academy of Gold Foil Operators	Nov. 1-2	Roney Plaza
American Academy of Oral Roentgenology	Nov. 1-2	Lucerne
American Academy of Pedodontics	Oct. 30-Nov. 1	Delano
American Academy of Periodontology	Oct. 31-Nov. 2	di Lido
American Association of Dental Editors	Nov. 2	Eden Roc
American Association of Dental Examiners	Nov. 1-2	Empress
American Association of Dental Schools	Nov. 3	Roney Plaza
American Association of Public Health Dentists	Nov. 2	Columbus
American College of Dentists	Nov. 3	Eden Roc Fontainebleau
American Dental Assistants Association	Nov. 4-7	Ivanhoe
American Dental Hygienists' Association	Nov. 4-7	Saxony
American Dental Society of Anesthesiology	Nov. 1-3	Sorrento
American Denture Society	Nov. 1-3	Americana
American Society of Dentistry for Children	Nov. 1-3	Balmoral
American Society of Oral Surgeons	Oct. 30-Nov. 2	Golden Gate Hotel
International College of Dentists	Nov. 3	Empress
Loyola University Dental Alumni Association Luncheon	Nov. 5	Sorrento
Marquette University Dental Alumni Association	Nov. 5	Biscayne Terrace
National Association of Seventh-Day Adventist Dentists	Oct. 31-Nov. 3	Algiers
Northwestern University Dental Alumni Association Luncheon	Nov. 6	San Marino
University of Maryland Alumni Association	Nov. 3-7	Seville
American Dental Interfraternity Council	Nov. 3	Saxony
Alpha Omega	Nov. 4	Eden Roc
Delta Sigma Delta	Nov. 1-4	Seville
Psi Omega	Nov. 4-7	Americana
Xi Psi Phi	Nov. 4	Shoremede

November 4-7. The color TV program has been made possible by the Smith, Kline and French Laboratories, which have assumed the entire cost of the program.

It is the first time in five years that color TV clinics have been part of an Association scientific session, and the first time that the new, improved compatible color TV used in commercial programs has been available to the annual meeting.

The procedures at the Dade County Clinic will be televised on large screens. Two-way communication will make it possible for the audience to ask questions of the clinician during the procedures.

In ten half-hour clinics, the following procedures will be viewed: cleft palate prosthesis, use of rubber base materials for gold inlays and fixed bridges, gingivectomy, construction of porcelain jacket crowns with high-speed cutting instruments, early detection of cancer, apicoectomy and construction of complete upper and lower dentures.

James L. Armstrong, one of the founders of the Dade County Clinic, and A. D. Farver, also prominent in the Clinic, are co-chairmen of the local committee on motion pictures and clinics and have arranged the TV program under the direction of the Council on Scientific Session.

Symposiums, clinics and motion pictures also are planned.

JUNE 30 IS DEADLINE FOR LIFE MEMBER APPLICATIONS

Applications for life membership to be acted on this year must be received in the Association's Central Office by June 30, announces Louis M. Cruttenden, Association assistant secretary. The applications received by that date will be voted on by the House of Delegates at the 98th annual session in Miami Beach November 4-7.

HOSPITAL DENTAL SERVICE WORKSHOP PROGRAM COMPLETE

The program for the first hospital dental service institute sponsored by the American Dental Association and the American Hospital Association has been completed. The institute-workshop will take place at the Willard Hotel in Washington, D. C., June 17-19. Purpose of the institute is to explore various aspects of hospital dental service; no recommendations of policy will be made.

Application for registration may be made through the American Dental Association, 222 E. Superior St., Chicago 11, or through the institute office of the American Hospital Association, 18 E. Division St., Chicago.

SHAILER PETERSON HONORED BY OMICRON KAPPA UPSILON

Shailer Peterson, Ph.D., secretary of the American Dental Association Council on Dental Education, has been awarded honorary membership in the Supreme Chapter of Omicron Kappa Upsilon, national honorary scholastic dental fraternity.

The distinction has been conferred on only one other person, Harlan Horner, former secretary of the Council. Dr. Peterson was cited for his outstanding contributions to the advancement of dental education. The award was presented March 24 at a banquet of the fraternity held during the annual meeting of the American Association of Dental Schools in Atlantic City.

In addition to the post as secretary of the American Dental Association's Council on Dental Education, Dr. Peterson has been a member, and since 1953, vice-president, of a three-man commission on dental education of the Fédération Dentaire Internationale. He is also a member of the W. K. Kellogg Foundation's dental advisory committee, a member of the Commission on Dental Education in the

South of the Southern Regional Education Board, and a member of the World Health Organization expert advisory panel on dental health.

PLAN SEPTEMBER WORKSHOP ON DENTAL ASSISTING

A steering committee meeting in Chicago February 5 laid preliminary plans for a September workshop on the training of dental assistants. On the committee were representatives of the American Dental Association's Council on Dental Education, representatives from the American Dental Assistants Association, the American Dental Hygienists' Association, as well as deans of dental schools and directors of training programs for auxiliary dental personnel.

The September workshop will attempt to outline the skills and abilities needed by assistants and to formulate educational standards for training programs for the dental assistants.

DAREDEVIL DAVEY COMIC BOOKS ARE SALE-PRICED

Savings up to 40 per cent on the Daredevil Davey dental health comic books have been announced by the American Dental Association. In a close-out sale affecting all six Daredevil Davey titles, the Association announced price reductions as follows: 50 books, formerly $4.60, now $3; 100 books, formerly $7.75, now $4.50. The books are sold as an assortment. Orders may be sent to the Order Department at the American Dental Association's Central Office.

DENTAL ABSTRACTS PUBLISHES ARTICLES FROM 45 COUNTRIES

More than 1,000 abstracts of articles appearing originally in periodicals from 45 countries were published in DENTAL ABSTRACTS in 1956. A year-end tally showed that the articles had been abstracted from 17 languages.

United States publications provided 447 items; German and Austrian publications 171. Seventy-eight came from England. Spanish-speaking countries, 11 in all, provided 60. Sweden and Switzerland provided 32 and 30, respectively.

DENTAL ABSTRACTS, published monthly, is designed to provide in quick reading form information on the latest developments in world dentistry. Subscriptions are $6 in the United States; $7 abroad. They may be obtained from the subscription Department at the Central Office.

DENTAL EDUCATION COSTS STUDENT $10,900, STUDY SHOWS

The typical dental student spends about $10,900 during his four years of dental school and is in debt to the tune of $4,230 when he receives his degree, a recently published survey reveals.

The survey, entitled *How Students Finance Their Dental Education*, was conducted by the American Dental Association's Council on Dental Education in cooperation with the Division of Dental Resources of the U. S. Public Health Service. It covers the characteristics, finances and practice plans of dental and dental hygiene students.

Although in dollar terms the $10,900 cost of a modern dental education is considerably more than the cost of a dental education in the early 1930's, increases in tuition and fees have done no more than compensate the schools for the decline in the value of the dollar, the report states. Of the total, about 40 per cent is for school costs; 60 per cent for living expenses.

The future student body will continue to have a large number of married students in spite of the fact that veterans, who are more likely to be married than nonveterans, are a decreasing proportion of the school population. The expected high percentage of married students will

have an impact on the provision of housing and other student facilities as well as on the cost of education, the report states.

For example, it was observed that the cost of a dental education bears only a limited relationship to tuition and related items, while the most striking differences are associated with marital status and consequent differences in living arrangements.

Students finance their education largely with funds obtained from within the family, either from parents or from wives, it was found. Forty per cent of all freshmen go into debt to finance their schooling; 60 per cent of seniors report indebtedness.

An additional observation was that most students plan to practice in their home states.

The survey shows that the cost of a two year education to the dental hygienist averages $3,039, one third of which is for school items and two thirds for living expenses. The average hygienist receives two thirds of her funds from parents. At graduation, one fifth of the students are in debt with a median indebtedness of $1,210. The report shows that 85 per cent of hygienists plan to work in their home states.

SUBSCRIPTS • Copies of the court decision in the F. B. Exner fluoridation case are available from the Council on Legislation at the Central Office. In that case, Dr. Exner of Seattle attempted to collect a $1,000 reward from the Chehalis Fluoridation League, which had offered to pay anyone who could prove fluoridation harmful. The Superior Court of Washington denied Dr. Exner's claim, stating it was convinced that scientific evidence proved the safety of the health measure. . . . The Council on Dental Trade and Laboratory Relations meets in the Central Office May 10 and 11. On its agenda will be the Federal Trade Commission's *Rules for the Commercial Dental Laboratory Industry*, enforcement of the federal mail order denture act and evaluation of recent A.D.A.-N.A.D.L. conferences on certification of laboratory technicians and accreditation of dental laboratories. . . . Lon W. Morrey, Association editor, has been reappointed to the committee on health of the National Congress of Parents and Teachers

Legislation

NEW BILL PROPOSES FUNDS TO BUILD TEACHING FACILITIES

An administration-sponsored bill to authorize 225 million dollars to subsidize construction of dental and medical teaching and research facilities was introduced into the House April 16. Of the 225 million dollars, 30 million would be earmarked for dental schools. The rest would be authorized for medical, public health and osteopathy schools and medical research institutions.

The measure would absorb into a five year program the current 90 million dollar, three year program which awards funds solely for construction of research facilities. The new bill would authorize funds for teaching facilities as well. Schools would still match federal grants on a 50-50 basis.

In announcing the proposal, HEW secretary Folsom declared, "We know that the need for medical research scientists, physicians, dentists and other skilled personnel in the health fields is increasing faster than the capacity of medical schools to train them. . . . In all too many instances, medical and dental schools do not have the financial resources to undertake the necessary construction, rehabilitation or expansion of their research and teaching facilities."

A recent study of the House Interstate and Foreign Commerce Committee re-

vealed that the nation's dental schools need about 77 million dollars for improvement of teaching facilities.

RESEARCH BUDGET, DOCTOR DRAFT HEARINGS POSTPONED

Senate hearings expected in April on the proposed 1958 budget for the Department of Health, Education and Welfare, which contains funds for dental activities of the U. S. Public Health Service, have been tentatively scheduled for some time this May. Also postponed to this month are the House hearings on the Department of Defense substitute for the physician-dentist draft act which expires June 30. The American Dental Association will testify on both measures.

Research Budget • Hearings on the HEW budget will take place before a Senate Appropriations subcommittee headed by Sen. Lister Hill (D., Ala.), a long-time proponent of research in the health field. Included in the measure is a 6.4 million dollar appropriation for dental health activities of the USPHS voted April 4 by the House of Representatives.

It is the full amount contained in the original budget submitted by the Administration and is somewhat more than the total approved by Congress for fiscal 1957. The appropriations for research were among the few items not cut by an economy-minded House. Floor leader who successfully piloted the measure through eight days of debate and 14 roll calls was Rep. John Fogarty (D., R.I.), chairman of the House subcommittee on appropriations.

When the American Dental Association testifies, it will urge inclusion of an appropriation for a building for the National Institute of Dental Research. The House committee, although it did not include funds for the building, stated that the need for the building is clear and that it could not understand why the Administration had turned down construction on the grounds of economy, since overcrowding has required the Institute to spend substantial sums for the rental of outside facilities.

Doctor Draft • H.R. 6548, the Defense Department substitute for the special physician-dentist draft, would set up machinery whereby dentists and physicians who are liable under the regular draft could be inducted under special calls. Thus, these men would not necessarily be inducted in the same order as nonmedical and nondental personnel. Physicians and dentists not subject to the regular draft could not be called.

The American Dental Association will urge continuation of the medical and dental advisory committee to selective service, a committee for which the Defense Department bill makes no provision.

Dental Societies

ARKANSAS SOCIETY PUBLISHES A STATE DENTAL HISTORY

The History of Dentistry in Arkansas, written by F. W. Dietrich and published under the auspices of the Arkansas State Dental Association, may now be ordered from the state association.

The 400 page, illustrated volume traces dentistry in Arkansas from about 1830 to 1956. It describes the changing conditions of practice of the individual dentist from the days when Arkansas was a territory, through the period of its early statehood, through the Civil War to the present. The book outlines also the growth of the state society. Minutes of the society from 1887 to 1905 are included in full. Additionally, all registered dentists in Arkansas since 1887 are listed.

Dr. Dietrich, the author, is a member of the American Academy of the History

of Dentistry and a Fellow of the American College of Dentists. He is a past president of the state dental association and has headed its history committee since its formation in 1950.

The book may be purchased for $10.

WILLARD OGLE DIES; WAS EDITOR OF TEXAS JOURNAL

Willard Ogle of Dallas, Texas, editor and secretary-treasurer of the Texas Dental Association, died April 11. He was 68 years old. Long prominent in dental circles, Dr. Ogle held posts in the local, state and national organizations. He had been president, editor and secretary of the Dallas County Dental Society. He was a founder of the Dallas Mid-Winter Dental Clinic and served as its secretary-treasurer. In 1933 he became editor of the state society's journal and Society secretary-treasurer in 1937. Dr. Ogle served two terms as American Dental Association Trustee for the Twelfth District from 1946 to 1952. He served also on the Association's Judicial Council.

Willard Ogle

He was active in the American Association of Dental Editors, serving a term as its editor and serving also on several of its committees. Last year, he was one of three men honored by the AADE for years in journalism.

Dr. Ogle was a Fellow of the American College of Dentists and the International College of Dentists. He was a member of Omicron Kappa Upsilon and Delta Sigma Delta.

The May issue of the *Texas Dental Journal* contains Dr. Ogle's last editorials, written from his sick bed.

In recognition of a combined total of nearly 150 years service to the profession and the public, three Toledo, Ohio, dentists have been awarded plaques by the Toledo Dental Society. Being congratulated by Gary E. Wright, president of the Toledo society, are (l. to r.): Ernest M. Bach, with 39 years service; William J. Cosgray, 52 years, and John J. Welker, 54 years. The men are former presidents of the Toledo society and have held offices also in the Ohio State Dental Association.

SUBSCRIPTS • Reports continue to come in regarding extensive celebrations held during February to mark National Children's Dental Health Week. Among these is the program of the Huntington Dental Society of Huntington, W. Va. Posters in grocery stores, advertisements by creameries urging consumption of milk, a TV movie, smile and poster contests were among some of the activities made possible by the society. . . . The Massachusetts Dental Society, the state Cerebral Palsy Association, and the Boston Floating Hospital sponsored a day-long workshop on dental care for the handicapped child April 2. The workshop was held at the New England Medical Center in Boston.

San Diego is the site of the August 19-22 Pacific Coast Dental Conference. Among tourist attractions is the stately California Tower with its rich, ornate architecture. It stands in Balboa Park, a recreation area of 1,400 acres, filled with colorful gardens, Spanish renaissance buildings and the famed San Diego Zoo.

Dental Education

USPHS CONSTRUCTION GRANTS AWARDED THREE SCHOOLS

Three dental schools were among 27 institutions awarded funds for construction of research facilities by the U. S. Public Health Service last month. The grants totaled $300,843.

The University of Rochester in Rochester, N. Y., received $248,681 for the addition of three floors to its medical and dental research laboratories. The Dental School, Fairleigh Dickinson University in Teaneck, N. J., received $32,500 for an animal house, and the School of Dentistry, Indiana University in Indianapolis, received $19,662 for research and teaching laboratories. It was the second grant to the Indiana school in the USPHS current fiscal year. Eight schools have received grants to date.

Research and teaching facilities construction grants are awarded under a $90,000,000 three year program authorized by Congress last year. The full appropriation for the first year has now been exhausted.

TEMPLE DENTAL SCHOOL MARKS 50TH ANNIVERSARY MAY 1

The School of Dentistry of Temple University in Philadelphia celebrated the 50th anniversary of its affiliation with the University May 1. A day-long session of scientific programs marked the event.

The school, formerly the Philadelphia Dental College, became part of Temple in 1907. It had been in operation since 1863, making the dental school the second oldest in the United States.

As part of the anniversary celebration, honorary doctor of science degrees were awarded to four distinguished members of the American Dental Association.

The degrees were conferred on Harry Lyons, Association president, who was speaker at the convocation ceremonies; Otto W. Brandhorst of St. Louis and Leslie M. FitzGerald of Dubuque, Iowa, former Association presidents, and Lester W. Burket of Philadelphia, chairman of the Association's Council on Dental Therapeutics and dean of the School of Dentistry, University of Pennsylvania. A dinner at the Drake Hotel, in honor of Gerald W. Timmons, dean of the school for 15 years and speaker of the Association's House of Delegates, climaxed the program.

CANADIAN DEAN ROY ELLIS IS PRESIDENT OF SCHOOLS' GROUP

Roy G. Ellis, dean of the Faculty of Dentistry, University of Toronto, was installed as president of the American Association of Dental Schools at its thirty-fourth annual meeting March 24-27 in Atlantic City, N. J. Dr. Ellis succeeds Lee Roy Main, dean of the School of Dentistry, St. Louis University.

Other deans elected to office were William H. Crawford, School of Dentistry, University of Minnesota, president-elect, and Robert W. McNulty, School of Dentistry, University of Southern California, vice-president.

George W. Teuscher, The Dental School, Northwestern University, was chosen executive committee member for the term ending in 1960, and Maynard K. Hine, School of Dentistry, Indiana University, was nominated for membership on the American Dental Association's Council on Dental Education.

The AADS also re-elected Marion W. McCrea of Baltimore secretary-treasurer and nominated Harry Blechman, associate professor of the College of Dentistry, New York University, for the American Dental Association's Council on the National Board of Dental Examiners.

The AADS reaffirmed its opposition to a bill currently in Congress which would authorize the Walter Reed Army Institute of Research to award advanced degrees in dentistry. In a second resolution, the schools' group urged the establishment of a DEND (Dental Education for National Defense) program. It proposed the start of a few pilot studies to evaluate curriculum, methods of support and results of such a program.

KANSAS DEAN RINEHART DIES; J. F. JACOBS IS ACTING DEAN

Roy J. Rinehart, dean of the University of Kansas City School of Dentistry, died March 24 of a heart attack. He was 76 years old. University trustees named assistant dean Joseph F. Jacobs acting dean. Dr. Jacobs, who is 36 years old, has been a member of the dental faculty since his graduation from the school in 1943. He has been assistant dean since 1953, is professor of periodontics and director of graduate courses.

R. J. Rinehart

The late Dean Rinehart spent 46 of his 55 years of dentistry in the field of dental education. A 1902 graduate of Western Dental College, he became its director in 1916. He was instrumental in achieving its merger three years later

with Kansas City Dental College. In the next period when many dental schools were closing, Dean Rinehart used some of his own funds to buy out stockholders and help incorporate the Kansas City school as a nonprofit institution. In 1941, he achieved its affiliation with the University of Kansas City. The dental school is now third largest in the United States.

Last year 1,400 alumni gathered to do him honor and name him "Man of the Year."

Dean Rinehart had been president of the Missouri State Dental Association and of the American Association of Dental Schools. He was a Fellow of the American College of Dentists, a member of the Fédération Dentaire Internationale, of Omicron Kappa Upsilon and Xi Psi Phi. He is survived by his wife.

$20,000 GRANT SUPPORTS TWO YEAR CLEFT PALATE PROGRAM

A grant of $20,000 to New York University College of Dentistry has been made by the trustees of the New York Foundation to support a two year program of dental care and rehabilitation for needy children with cleft palate and cleft lip handicaps. The Foundation supports projects in health, medicine, social welfare and teaching.

The College of Dentistry will open its rehabilitation center this month on the college campus, 209 East 23 Street, in New York City.

ILLINOIS ALUMNI HONOR NELL SNOW TALBOT ON RETIREMENT

Mrs. Nell Snow Talbot, long-time teacher and assistant to the dean of the College of Dentistry, University of Illinois, will be honored on her retirement at a testimonial dinner June 8. The dinner is being given by the University's Alumni Association and faculty.

Mrs. Talbot, professor of medical and dental history, retires after 33 years on the faculty. Her special teaching talents led dental students in 1950 to establish the annual Nell Snow Talbot Instructorship Awards presented to faculty members for excellence in teaching.

ORAL PATHOLOGY FELLOWSHIP AVAILABLE AT PENNSYLVANIA

A fellowship in oral pathology, supported by the American Cancer Society, is available at the School of Dentistry, University of Pennsylvania, in Philadelphia. The one year fellowship begins August 1 and carries a stipend of $3,600. Six months credit is granted by the American Board of Oral Surgery to the Fellow, and credits can be earned also toward an advanced degree. Applicants may write to C. E. Wilde, Jr., department of pathology, at the school.

EDUCATION CONFERENCE MARKS INAUGURATION OF CHANCELLOR

A conference on dental education will mark the inauguration of Edward Harold Litchfield as twelfth chancellor of the University of Pittsburgh May 10. Theme of the dental school conference is "dental education in the next quarter century."

Research, changes in school curriculum, financial needs of dentistry and socioeconomic factors affecting dental education will be discussed by four essayists. Participating in the program are: Joseph C. Volker, dean of the School of Dentistry, University of Alabama in Birmingham; Lloyd E. Blauch, Ph.D., director of the division of higher education, U. S. Department of Health, Education and Welfare; Philip E. Blackerby, Jr., associate director of the W. K. Kellogg Foundation in Battle Creek, Mich., and So Wah Leung, director of graduate education, School of Dentistry, University of Pittsburgh, Willard C. Fleming,

dean of the School of Dentistry, University of California in San Francisco, will keynote the conference and serve as moderator of a panel discussion.

SHORT COURSES OFFERED FOR PRACTICING DENTISTS

Alabama • Refresher courses for the month of June at the University of Alabama School of Dentistry in Birmingham are: surgical anatomy of the head and neck, June 3-5; etiology and diagnosis of pain of dental origin, June 6 and 7, both courses by Harry Sicher, and preventive orthodontics, June 15-17, by Earl E. Shepard. Dr. Sicher is chairman of the department of anatomy and oral histology at Loyola (Chicago) University dental school. Dr. Shepard is chairman of the department of clinical orthodontics, Washington University in St. Louis.

California • Five refresher courses during May and June have been announced by the University of California Medical Center in San Francisco. A dental medicine seminar is offered May 3 and 4; oral rehabilitation, May 23-25; immediate dentures, June 8; hydrocolloids, June 7-9, and periodontics, June 20-22.

Indiana • A course in complete denture prosthesis will be taught June 19-24 at Indiana University School of Dentistry in Indianapolis. Each student will construct a denture for a clinic patient. The clinical aspects of the course will be supplemented by a discussion of diagnosis, impression procedures, jaw relation records, selection and positioning of teeth and special methods for individualizing restorations.

Loyola (Chicago) • A course in analgesia and anesthesia is available at Loyola University School of Dentistry in Chicago. The class, given Wednesday afternoons and Thursday mornings, will include lectures, demonstrations and student participation. Clinic and hospital operative room service will be studied.

Mississippi • A two day conference on oral diagnosis, roentgenology and treatment planning is being sponsored August 21 and 22 by the University of Mississippi Center for Continuation Study. Clinicians will include William R. Alstadt, president-elect of the American Dental Association, Lee Roy Main, dean of the School of Dentistry, St. Louis University; Beryl Ritchey of Colorado Springs, and Hamilton B. G. Robinson, associate dean of the School of Dentistry, Ohio State University. The University of Mississippi is in the town of University.

Pennsylvania • Joseph Johnson will teach a course on the twin wire mechanism June 3-7 at the School of Dentistry, University of Pennsylvania, in Philadelphia. Applicants for the course must be members of the American Association of Orthodontists or hold certificates from recognized graduate classes in orthodontics.

A course in complete denture prosthesis, designed for the general practitioner, is offered June 24-29. H. Milton Rode will teach.

Southern California • Practical root canal therapy is offered May 4-7 by the University of Southern California School of Dentistry in Los Angeles. John I. Ingle, professor of endodontics and periodontics at the University of Washington in Seattle, will direct a faculty of four. Practical demonstrations and clinical participation are included. The school also offers a class in minor oral surgery. Scheduled June 17-21, the course will be taught by clinical sessions followed by round table discussion.

Tufts • Irving Glickman and staff will teach a special participation course in periodontology at Tufts University School of Dental Medicine in Boston. The course, October 7-11, will devote half time to clinical sessions in which participants will treat patients under Dr. Glickman's supervision.

Washington • A refresher course in exodontics and minor oral surgery has been announced by the University of Washington School of Dentistry in Seattle. The course, June 3-14, is designed for the general practitioner and will be taught by lecture and clinical instruction. There is a faculty of 15.

ADD PUBLIC HEALTH MINOR TO COLUMBIA HYGIENISTS' COURSE

A revised curriculum in courses for dental hygienists at the School of Dental and Oral Surgery, Columbia University, New

York, provides for a minor in public health. The new curriculum is designed to qualify graduates for a permanent dental hygiene teaching license in New York State as well as for public health service. Admission is based on 60 credits of college courses, the program is two years in length, and a bachelor of science degree is awarded graduates.

Public Health

PARADE MAGAZINE CARRIES FLUORIDATION STORY

An article entitled "What You Should Know About Fluoridation" is a feature of the May 12 issue of *Parade,* a Sunday magazine carried in 55 newspapers with a circulation of nearly seven and a half million. The article is written by Harry Lyons, dean of the School of Dentistry, Medical College of Virginia, and president of the American Dental Association.

Parade's front cover will carry the line "An expert discusses fluoridation." Written in simple and interesting fashion, Dr. Lyon's article points out that fluoridation is safe, effective and inexpensive. The various arguments advanced by anti-fluoridationists are examined and answered, and the public is urged to listen to scientists in forming opinions.

"It is high time that the public listen more attentively to the voices of our research workers and health servants, whose lives are dedicated to its welfare," the Association president asserts.

A.M.A. OFFICIAL POLICY IS TO SUPPORT FLUORIDATION

An official statement has been released by the American Medical Association in response to inquiries regarding its stand on water fluoridation. The A.M.A. statement affirms the medical group's continued support of the health measure and points out that the study called for at its last convention in no way changed that support. Text of the official statement follows:

> The American Medical Association has not changed its position on the fluoridation of public water supplies to prevent dental caries in children.
>
> The House of Delegates at its December 1951 meeting unanimously endorsed the principle of fluoridation of public water supplies, and this position still stands.
>
> The action of the House of Delegates at its November 1956 meeting has been misinterpreted to mean that some change in the AMA's position has taken place; this is not the case. At that time, the House of Delegates directed the Association's Council on Drugs and Council on Foods and Nutrition to conduct a joint study of all presently available information concerning the fluoridation of public water supplies and that a documented report of the findings, together with any recommendation arising from these findings be presented to the House of Delegates at its meeting in Philadelphia in December 1957.

SOCIETY CITES DAVID AST, NEW YORK DENTAL DIRECTOR

David B. Ast, New York State's dental director, was cited at an Albany, N. Y., dinner meeting of the Third District Dental Society.

The plaque awarded Dr. Ast read in part, "In recognition of his outstanding contribution to dentistry through his pioneering direction of the fluoridation, dental rehabilitation and general dental health services for the people in New York State."

Dr. Ast was a leading figure in the Newburgh-Kingston caries-fluoride study, one of the first controlled studies which demonstrated the value of fluoridated water. It was his thesis in 1942, outlining a plan to test the caries-fluorine hypothesis, which served as the basis of the Newburgh-Kingston study. The ten year final report was presented in December 1955, with Dr. Ast reporting on the dental aspects of the study. Children in Newburgh who had been drinking

fluoridated water all their lives had 58 per cent less dental caries than children in Kingston, the nonfluoridated control city, the study showed.

SUBSCRIPTS • Fluoridation is a "safe and efficient means of improving the dental health of the nation without harm to pets or animals" states a resolution adopted by the Conference of Public Health Veterinarians. The dental health measure has been approved also by the College of American Pathologists. . . . Mr. Leonard J. Dolton has been employed by the Los Angeles County Dental Society for the newly created post of dental health education coordinator. The society anticipates a comprehensive education program. . . . The Connecticut Advisory School Health Council, an organization of the state departments of health and education, has developed a teacher reference guide on fluoridation for distribution to all superintendents of schools in the state. The guide contains information on the history of the health measure, early programs, endorsing organizations and legal status as well as a reference list. . . . La Salle, Ill., population 12,083, has started water fluoridation. . . . Katherine Brownell Oettinger, dean of the School of Social Work at Boston University, has been named chief of the Children's Bureau in the Department of Health, Education and Welfare. Dean Oettinger is the first mother to hold the post.

National Defense

ARMY DENTAL UNIT APPROVES 11 RESEARCH PROJECTS

Approval of 11 research contracts by the Office of the Surgeon General was recommended late in March by the Army dental research advisory committee. Eight of the contracts are for renewals, and three are new applications.

New projects are: "Use of the Papanicolaou Technic on Oral Lesions," Richard W. Tiecke, Northwestern University Dental School; "Evaluation of Methods for Processing Resin Dentures," Floyd A. Peyton, University of Michigan School of Dentistry, and "Endamoeba Gingivalis and Trichomonas Tenax," Wayne W. Wantland, Ph.D., of Illinois Wesleyan University.

Scientists receiving renewal grants are: John M. Slack, Ph.D., West Virginia University School of Medicine; Frederick W. Kraus, University of Alabama School of Dentistry; Irving Glickman, Tufts University School of Dental Medicine; Harry Shapiro, College of Physicians and Surgeons, Columbia University; Henry W. Scherp, Ph.D., University of Rochester School of Medicine and Dentistry; Joseph P. Weinmann, University of Illinois College of Dentistry; Helmut A. Zander, Eastman Dental Dispensary, and Robert E. Moyers, University of Michigan School of Dentistry.

CLARENCE P. CANBY PROMOTED TO ARMY BRIGADIER GENERAL

Clarence P. Canby, chief of the dental service, Letterman Army Hospital in San Francisco, has been promoted to the rank of brigadier general, the Department of the Army announced April 3. General Canby has served in the Army for 30 years.

He is a 1927 graduate of the College of Dentistry, State University of Iowa, and was commissioned in the Army the same year. In 1945 he was assigned to the headquarters of the Tenth Army, Pacific Theater of Operations, as dental surgeon,

and then to the headquarters of the Army Forces in the Western Pacific. In 1947 he was named chief of the dental service at Tilton Army Hospital, Fort Dix, N. J. Later he served in the same capacity at Brooke Army Hospital in Fort Sam Houston, Texas.

In 1954, General Canby was named dental surgeon at the headquarters of the U. S. Army Forces in the Far East, and in January of this year became chief of the dental service at Letterman.

General Canby is a member of the International Association of Dental Research and a Fellow of the American College of Dentists.

ADMIRAL RIEBE RETIRES; JOINS CALIFORNIA FACULTY

Rear Admiral Herman P. Riebe, (DC) USN, inspector general for dentistry of the Bureau of Medicine and Surgery in the Navy Department, retired April 1. He had had more than 30 years of active service.

Admiral Riebe will join the staff of the College of Dentistry, University of California, in San Francisco.

Admiral Riebe

His career in the Navy began in 1926, when he was commissioned as an assistant dental surgeon with the rank of lieutenant, jg. He served on numerous ships and Navy shore establishments and in 1951 was appointed rear admiral. He has held the post of inspector general since 1955.

NAVY SELECTS 40 FOR SENIOR STUDENT PROGRAM

Forty junior dental students have been selected from 113 candidates for participation in the Navy's senior dental student program, the Navy announced in mid-April. The students will be placed on active duty as ensigns while they finish school and will be commissioned as lieutenant, jg., in the regular Navy on graduation. At the same time, the Navy announced that 18 seniors, graduating in June, have been selected for one year internships.

SUBSCRIPTS • The Legion of Merit award was presented March 15 to Capt. Robert A. Colby, (DC) USN, for writing and editing a book entitled *Color Atlas of Oral Pathology*. The book has been deemed by reviewers to be a work of extreme scientific and practical value. . . . A recent study by the National Bureau of Standards shows that radiation exposure resulting from an atomic blast can be estimated from the fogging of ordinary photographic and dental x-ray film. Thus examination of film stocked in drug stores and available in dental offices would reveal the radiation pattern in the event of an attack. The study was conducted for the Federal Civil Defense Administration.

Research

IADR HONORS SENATOR HILL FOR SUPPORT OF RESEARCH

Senator Lister Hill (D., Ala.) was named as the first honorary officer of the International Association of Dental Research at its 35th general meeting in Atlantic

City, N. J., March 21-24. Senator Hill was commended for his "outstanding interest in and support of dental research." The honorary post was created by adoption of a revised constitution and bylaws.

The group also cited Edward H. Hatton of Evanston, Ill., one of the founders of the IADR and its secretary-treasurer since 1938. A testimonial dinner was held in his honor. Dan Y. Burrill of Louisville, Ky., was chosen secretary-treasurer to succeed Dr. Hatton.

Other new officers are: Reidar F. Sognnaes of Boston, president; Ned B. Williams of Philadelphia, president-elect; Hamilton B. G. Robinson of Columbus, Ohio, vice-president, and Thomas J. Hill of Cleveland, trustee.

100 SCIENTISTS TO MEET AT GORDON RESEARCH CONFERENCE

The 1957 Gordon Research Conference of the American Association for the Advancement of Science will be held June 10 to August 30 at three cooperating schools in New London, New Hampton and Meriden, N. H. The conference, limited to 100 participants, will review the latest developments in research on the chemistry, physiology and structure of bones and teeth, as well as outline possible paths for future study.

Among topics to be discussed are the fine structure of bones and teeth, parathyroids and regulation of blood calcium, radiostrontium metabolism, effect of hormones on the skeleton and enzymes of bone.

The conference will consist of scheduled lectures and discussion groups with time provided for reading and recreation. It is designed to permit participating scientists in related fields to become acquainted and discuss work in progress.

Details on the conference may be obtained from W. George Parks, director, department of chemistry, University of Rhode Island, Kingston, R. I.

SUBSCRIPTS • Visitors from other countries to the dental research facilities of the National Bureau of Standards in Washington, D. C., have included in recent months Rio Yamauchi and Iwao Nagai of Japan, R. A. DeWilde of Belgium and M. A. Arnan of Tel Aviv. . . . Dental schools have been advised of the availability of U.S. Public Health Service fellowships for undergraduate students interested in training in research. Applicants' names were submitted to the USPHS for its postsophomore research fellowship training grants April 29.

International

EGYPTIAN DENTAL SCHOOL SEEKS TEACHERS FROM U. S.

Positions as associate professors and professors are open at the College of Dentistry, Cairo University, in Egypt. Teachers are needed in the fields of oral medicine, operative dentistry and prosthodontics. The teaching language is English. Previous teaching experience is required of candidates. Information on salaries, travel expenses and bonuses may be obtained from the Egyptian Education Bureau, 2300 Decatur Pl., N.W., Washington 8, D. C.

U. S. DENTISTS LEAD LIST FOR F.D.I. CONGRESS ATTENDANCE

More dentists from the United States than from any other country have registered for the Fédération Dentaire Internationale's Twelfth International Dental Congress to be held September 7-14 in Rome, Italy, according to a report received from O. H. Moen, F.D.I. treasurer for the United States.

As of mid-March 303 U. S. dentists had enrolled. The United Kingdom had registered 239; the Netherlands, 147. Next highest was Finland with 94. About

50 national dental associations are F.D.I. members.

Simultaneous translation into five languages is planned for the Congress proceedings. The scientific program will include essays, clinics and motion pictures. To date, 11 countries have applied for exhibit space.

Special housing arrangements have been made for students in youth hostels. Camping grounds within the exposition zone also are available, and arrangements can be made for camping on the beach at Ostia.

Congress enrollment forms, hotel reservation forms, and F.D.I. membership applications may be obtained from Dr. Moen, Masonic Temple, Watertown, Wis.

GERMANO TABACOF HEADS BRAZILIAN GROUP FOR 1957

Germano Tabacof has been elected president of the Nucleo de Estudos Odontologicos da Bahia in Salvador, Brazil, for the 1956-1957 term. Accompanying Dr. Tabacof into office are Giuseppe Mazzoni, first secretary; Aloysio Lopes Pontes, second secretary; Antonio Tourinho Ribeiro, treasurer, and Hemilton Drumond, librarian.

CANADIAN DENTAL CONVENTION FEATURES U. S. CLINICIANS

Three United States dentists are featured on the scientific program of the Canadian Dental Association's 1957 convention to be held in Winnipeg June 23-26.

They are Samuel C. Miller of New York, chairman of the department of periodontics and oral medicine at the College of Dentistry, New York University; V. R. Trapozzano of St. Petersburg, Fla., consultant in prosthetic dentistry to the U. S. Armed Forces, and Ralph W. Phillips, M.S., of Indianapolis, chairman of the department of dental materials at Indiana University School of Dentistry.

The 1957 convention of the Canadian Dental Association is being held in cooperation with the Western Canada Dental Society. K. M. Johnson is president of the national organization. Warren J. Riley heads the western group.

SUBSCRIPTS • A dental health exhibit, including a film on water fluoridation, has been scheduled for display at two international trade fairs. Dates are April 12-27 in Milan, Italy, and June 1-20 in Barcelona, Spain. The display was prepared by the U.S. Department of Commerce in cooperation with the American Dental Association's Bureau of Public Information. . . . The ratio of dentists to population in Canada is one to 2,934, reports the Canadian Dental Association. The year previous it was one to 2,881. The ratio is expected to worsen for some years until teaching facilities, now in the planning stage, actually produce more graduates. . . . The German Society of Dentistry meets in Dusseldorf June 14-16, and the German Society for Oral and Facial Surgery in Munich July 25-27.

General

NEW YORK COURT RULES BLUE SHIELD MUST PAY DENTISTS

The New York State Supreme Court has ruled that United Medical Service, Inc., (Blue Shield companies of New York) must pay dentists for oral surgery procedures which they perform under the companies' medical expense indemnity contracts. In so ruling, the high court upheld an earlier decision of New York's former Attorney General Jacob K. Javits.

On February 3 more than 150 friends of Edward R. Hart (second from right), Missouri dentist now in his fifty-seventh year of practice, gathered to pay him honor at a banquet in the Conrad Hilton Hotel, Chicago. With Dr. Hart are (l. to r.): John M. Marre, president of the St. Louis Dental Society; Max Kornfeld, president of the Missouri State Dental Association; Arthur F. Schopper, Trustee of the Sixth District who served as toastmaster; and W. S. Tucker of New Orleans, who was in charge of general arrangements. Not shown is W. W. Oursler, chairman of the event. More than 18 speakers paid tribute to Dr. Hart, who is former head of the section of crown and bridgework, St. Louis University School of Dentistry, and a past president of the American Academy of Restorative Dentistry.

A 1953 amendment to the state's insurance law expanded the definition of medical expense indemnity to cover "dental care provided through duly licensed dentists," but six of the seven Blue Shield companies had refused payment. In appealing to the state supreme court, they claimed that the insurance commissioner had no right to direct payment and that the amended section of the insurance law was unconstitutional. Both claims were rejected by the court.

NATION-WIDE POLL OF DENTISTS STARTS IN MID-MAY

A nation-wide sample of practicing dentists will be interviewed in mid-May by the National Opinion Research Center of the University of Chicago. The survey, on the subject of the dentist and his practice, is under the sponsorship of the American College of Dentists. Study results in summary terms will be made available to the profession.

NEW SERIES OF DENTAL BOOKS TO APPEAR TRIANNUALLY

A new series of book-journals entitled *The Dental Clinics of North America* is being undertaken by W. B. Saunders Co., Philadelphia publishing house. The book-journals, under the editorship of Robert E. Wright, will appear three times a year. Each issue is to be a symposium on one or two dental subjects. Contributors, as well as the guest editor of each volume, will be experts in their fields.

The first issue, March of this year, contained two symposiums, "New Developments in Operative Dentistry,"

The Linen Supply Association's 3,200 delivery trucks in the United States and Canada will carry a dental health message this month. The four-color poster, which urges "See your dentist twice a year," is one of 12 public service posters used by the Association during the year.

edited by Drexell A. Boyd, and "Differential Diagnosis of Prosthodontic Needs," edited by Raymond J. Nagle.

Scheduled for July issuance is "Emergencies in Dental Practice," edited by James R. Cameron. The November book will be edited by Hamilton B. G. Robinson and Robert G. Kesel, that scheduled for March 1958 by F. Darl Ostrander. Lester W. Burket and Ralph W. Phillips will edit succeeding issues.

TRADE GROUP'S GIFT WILL DEVELOP ACCOUNTING MANUAL

A standard manual of accounting for dental laboratories will be developed as a result of a $2,000 gift presented March 1 in Washington, D. C., to the National Association of Dental Laboratories. The check was presented to NADL president Nathan Cooper by American Dental Trade Association president G. Molton Goolsby, in the name of his organization.

Also • A special plane has been chartered by the Association for Professional Advancement to take members and their families to the Twelfth International Dental Congress in Rome this fall. The plane leaves from New York for London August 23 and returns from Brussels or Paris October 3. Interested persons may contact J. Gerald Rosen, secretary-treasurer, 150 S. Harrison St., East Orange, N. J. . . . Delta Sigma Delta Fraternity will celebrate its Diamond Jubilee in Ann Arbor, Mich., June 14. A bronze plaque will be unveiled at its Alpha chapter at that time. . . . The New York Metropolitan Society of Oral Surgeons will meet at West Point May 1. . . . W. Ward Tracy of New York City was installed as president of the New York Academy of Dentistry April 11. Wilbur J. Prezzano of White Plains was chosen president-elect. . . . A dentist's wife, Mrs. Albert J. Altman, is one of three women inventors who will exhibit at the Michigan state fair grounds during the First National Inventions and Gadget Exposition in May.

Deaths

Ash, Barnet, Long Island City, N. Y.; Columbia University School of Dental and Oral Surgery, 1924; died November 12, 1956; aged 53.

Diggs, Paul S., East Moline, Ill.; St. Louis University School of Dentistry, 1916; died November 29, 1956; aged 68.

D'Oench, Harry F., Creve Coeur, Mo.; Washington University School of Dentistry, St. Louis, 1895; died December 31, 1956; aged 81.

Lehman, Russell W., Terre Haute, Ind.; Indiana University School of Dentistry, 1927; died December 2, 1956; aged 53.

Lehman, Walter L., Coudersport, Pa.; University of Pennsylvania School of Dentistry, 1918; died December 28, 1956; aged 61.

Levine, Abraham J., Brooklyn; New York College of Dentistry, 1918; died October 31, 1956; aged 62.

Luongo, Frank J., Brooklyn; New York University College of Dentistry, 1927; died July 31, 1956; aged 53.

Malcik, Alfred J., Rosenberg, Texas; Baylor University College of Dentistry, 1951; died December 10, 1956; aged 35.

Mason, Paul H., Mocksville, N. C.; Baltimore College of Dental Surgery, University of Maryland, 1919; died November 29, 1956; aged 61.

Matson, Edwin, Chicago; Chicago College of Dental Surgery, Loyola University, 1926; died August 13, 1956; aged 58.

McAllister, Charles A., Kent, Wash.; St. Louis University School of Dentistry, 1929; died January 15, 1957; aged 54.

McBride, Frank P., West Warwick, R. I.; University of Maryland, 1914; died December 1956; aged 70.

McGhee, James L., Kansas City, Mo.; St. Louis University School of Dentistry, 1924; died December 11, 1956; aged 56.

McIntee, John T., Rochester, N. Y.; University of Buffalo School of Dentistry, 1902; died December 24, 1956; aged 77.

McKeon, Edward J., Taunton, Mass.; University of Maryland, 1920; died December 15, 1956; aged 71.

McNaughton, John, Charleroi, Pa.; Pittsburgh Dental College, Western University of Pennsylvania, 1905; died December 5, 1956; aged 80.

Meade, Mary B., Carmi, Ill.; St. Louis Dental College, 1907; died December 8, 1956; aged 75.

Middleton, William R., Andalusia, Ala.; Vanderbilt University School of Dentistry, 1905; died January 4, 1957; aged 77.

Mohler, James B., Cleveland; Western Reserve University College of Dentistry, 1909; died December 20, 1956; aged 72.

Morris, Charles R., East Palestine, Ohio; Cincinnati College of Dental Surgery, 1910; died December 31, 1956; aged 71.

Motley, Joseph W., Memphis, Tenn.; University of West Tennessee Dental Department, Memphis, 1919; died February 21, 1956; aged 65.

Neckritz, Morris I., Brooklyn; New York College of Dentistry, 1916; died November 24, 1956; aged 61.

Nesbit, William D., Jr., New Haven, Conn.; Baltimore College of Dental Surgery, University of Maryland, 1924; died November 28, 1956; aged 55.

O'Hagan, John H., Ogdensburg, N. Y.; University of Pennsylvania School of Dentistry, 1896; died December 26, 1956; aged 86.

Olinger, Bert C., The Dalles, Ore.; North Pacific College of Oregon, School of Dentistry, Portland, 1905; died January 5, 1957; aged 77.

Parker, Ralph I., Minerva, Ohio; died December 9, 1956; aged 66.

Pawlowski, Anthony C., Buffalo; University of Buffalo School of Dentistry, 1915; died December 22, 1956; aged 64.

Peterson, Elmer C., Sheffield, Ill.; Northwestern University Dental School, 1900; died June 22, 1956; aged 82.

Pollock, Leo L., Oklahoma City; Western Dental College, Kansas City, 1911; died October 26, 1956; aged 64.

Prather, Edward H., Houston, Texas; Texas Dental College, Houston, 1927; died December 14, 1956; aged 52.

Pruden, William H., Paterson, N. J.; New York College of Dentistry, 1888; died January 5, 1957; aged 95.

Purviance, Byram S., Los Angeles; University of Southern California College of Dentistry, 1917; died December 13, 1956; aged 63.

Quinius, Julius H., New Orleans; Tulane University School of Dentistry, 1912; died June 10, 1956; aged 68.

Raeder, Emil G., Dover Plains, N. Y.; New York Dental School, 1900; died December 29, 1956; aged 76.

Ray, Ralph Moore, Chicago; Northwestern University Dental School, 1945; died December 13, 1956; aged 36.

Reade, Arthur P., Durham, N. C.; Baltimore College of Dental Surgery, University of Maryland, 1907; died November 28, 1956; aged 75.

Reichard, Harry C., Conshohocken, Pa.; University of Pennsylvania School of Dentistry, 1924; died December 30, 1956; aged 58.

Rice, Herbert C., Chicago; Ohio College of Dental Surgery, University of Cincinnati, 1905; died August 28, 1956; aged 73.

Richmond, Claude M., St. Johnsbury, Vt.; Tufts University School of Dental Medicine, 1901; died December 1956; aged 77.

Ritter, Glenn A., Lawrenceville, Ill.; St. Louis University School of Dentistry, 1924; died November 30, 1956; aged 64.

Robertson, William L., Albany, Ore.; North Pacific College of Oregon, School of Dentistry, Portland, 1921; died December 19, 1956; aged 64.

Robinson, John W., Roanoke, Va.; Baltimore Medical College Dental Department, 1909; died February 17, 1956; aged 76.

Rossman, John H., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, Portland, 1919; died December 23, 1956; aged 68.

Scharff, Earle U., Memphis, Tenn.; University of Tennessee College of Dentistry, 1916; died December 15, 1956; aged 62.

Schutzmann, Arthur M., Baton Rouge, La.; Atlanta-Southern Dental College, 1919; died December 13, 1956; aged 62.

Shafton, Ralph, New York; New York College of Dentistry, 1917; died December 17, 1956; aged 62.

Siemer, Frederick W., Chicago; University of Illinois College of Dentistry, 1924; died December 22, 1956; aged 60.

Springer, Simon H., New York; Tufts University School of Dental Medicine, 1913; died December 22, 1956; aged 67.

Stevens, Burt R., Seattle; North Pacific College of Oregon, School of Dentistry, Portland, 1902; died August 1956; aged 76.

Stiefel, Morris W., New York; New York College of Dentistry, 1910; died December 8, 1956; aged 70.

Strock, David F., Elkins, W. Va.; Pennsylvania College of Dental Surgery, Philadelphia, 1899; died December 11, 1956; aged 84.

Strohmann, Adolph F., West Haven, Conn.; died December 5, 1956; aged 68.

Tate, Lester H., Canton, Ohio; University of Tennessee College of Dentistry, 1908; died December 11, 1956; aged 70.

Travis, John J., Ann Arbor, Mich.; University of Michigan College of Dental Surgery, 1903; died December 21, 1956; aged 84.

Walters, Frank H., Pontiac, Mich.; died December 4, 1956; aged 85.

Ward, Ward S., Kearney, N. J.; College of Dental and Oral Surgery, New York, 1918; died November 1956; aged 59.

Welch, Dennis, Ashley, Ohio; Starling-Ohio Medical College, Department of Dentistry, 1908; died January 12; aged 72.

Welch, Frank M., Linton, Ind.; Northwestern University Dental School, 1899; died January 1, 1957; aged 78.

Weinberg, Percy A., Paterson, N. J.; University of Pennsylvania School of Dentistry, 1922; died January 18; aged 56.

Weinstein, Herman, Forest Hills, N. Y.; New York College of Dentistry, 1915; died November 15, 1956; aged. 62.

Westbrook, John D., Rule, Texas; died January 4; aged 79.

Weyand, Kenneth M., Allentown, Pa.; University of Pennsylvania School of Dentistry, 1918; died December 11, 1956; aged 60.

White, Sherman A., San Francisco; University of California College of Dentistry, 1913; died January 6; aged 65.

Whitten, Idus, Hazelhurst, Miss.; Southeastern Dental University, Atlanta, 1912; died October 20, 1956; aged 66.

Wild, Walter H., Lincoln, Neb.; Lincoln Dental College of Cotner University, 1910; died January 9; aged 68.

Willson, Ellis O., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, Portland, 1904; died January 10; aged 76.

Wilson, Ernest H., Miller, S. D.; Northwestern University Dental School, 1899; died December 28, 1956; aged 80.

Winslow, William W., Philadelphia; University of Pennsylvania School of Dentistry, 1919; died January 2; aged 63.

Woelffer, John R., Milwaukee; Marquette University Dental School, 1914; died January 21; aged 64.

Wolfe, Morris R., Kansas City, Mo.; Northwestern University Dental School, 1901; died December 1956; aged 76.

Woofter, Jesse A., Weston, W. Va.; Ohio College of Dental Surgery, University of Cincinnati, 1900; died December 10, 1956; aged 84.

Wrobel, Stanislaus, Meriden, Conn.; University of Louisville School of Dentistry, 1914; died November 29, 1956; aged 65.

Wrobleski, Edmund J., Chicago; Northwestern University Dental School, 1917; died August 24, 1956; aged 66.

Yahres, John M., Sharon Pa.; Chicago College of Dental Surgery, Loyola University, 1897; died September 8, 1956; aged 86.

Yungblut, Donald C., Lincoln, Neb.; University of Nebraska College of Dentistry, 1932; died January 18; aged 47.

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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION
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All expressions of opinion and all statements of supposed fact are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association. Articles are accepted with the understanding that they have not been published previously and that they are submitted solely to The Journal. The Journal of the American Dental Association is indexed in the Index to Dental Literature, in the Current List of Medical Literature and, in part, in the Quarterly Cumulative Index Medicus, Biological Abstracts and Chemical Abstracts.

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Eighth Annual Session	Nov. 4-7, 1957	Miami, Fla.
Ninety-Ninth Annual Session	Nov. 10-13, 1958	Dallas, Texas
One-Hundredth Annual Session	Sept. 21-24, 1959	New York
One-Hundred and First Annual Session	Oct. 17-20, 1960	Los Angeles

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama			F. A. Finney, Jr.	Box 787, Gadsden
Alaska	June 5-8	Ketchikan	C. L. Polley	Box 1896, Juneau
Arizona	May 1-4	Chandler	W. G. Burke	17 E. Weldon Ave., Phoenix
Arkansas			D. M. Hamm	Box 89, Clarksville
California	Apr. 21-23, 1958	San Francisco	W. J. Healy	450 Sutter St., San Francisco
S. California			S. M. Silverman	903 Crenshaw Blvd., Los Angeles 19
Colorado	Oct. 6-9	Colorado Springs	G. H. Jackson	724 Republic Bldg., Denver
Connecticut	May 15-17	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			A. G. Schick	3716 Philadelphia Pike, Claymont
District of Columbia	Mar. 9-12, 1958	Washington	J. F. Keaveny	1029 Vermont Ave., N. W., Washington
Florida			W. C. Mayo	Brent Annex, Pensacola
Georgia	Sept. 29-Oct. 2	Atlanta	J. W. Yarbrough	Southern United Bldg., Macon
Hawaii	June	Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	May 16-18	Pocatello	M. R. Johnson	1606 E. Center St., Pocatello
Illinois	May 12-15	Peoria	P. W. Clopper	632 Jefferson Bldg., Peoria
Indiana	May 20-22	Indianapolis	W. R. Shoemaker	Citizens Bank Bldg., Anderson
Iowa	May 5-8	Des Moines	H. I. Wilson	Insurance Exchange Bldg., Des Moines
Kansas	May 13-16	Wichita	F. A. Richmond	Brotherhood Bldg., Kansas City 1
Kentucky			A. B. Coxwell, Jr.	1976 Douglass Blvd., Louisville
Louisiana			J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 20-22	Kennebunkport	S. M. Gower	Box 27, Skowhegan
Maryland	May 5-8	Baltimore	C. L. Inman, Jr.	Medical Arts Bldg., Baltimore
Massachusetts	May 5-8	Boston	H. E. Tingley	12 Bay State Rd., Boston 15
Michigan			F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Apr. 14-16, 1958	St. Paul	C. V. E. Cassel	2236 Marshall Ave., St. Paul 4
Mississippi			B. A. Cohen	500-E E. Woodrow Wilson Dr., Jackson 27
Missouri	May 26-29	St. Louis	E. D. Suggett	Merchants Bank Bldg., Jefferson City
Montana	May 1-3	Billings	E. G. Vedova	Box 311, Roundup
Nebraska			F. A. Pierson	Federal Securities Bldg., Lincoln
Nevada	May 5-7	Las Vegas	O. M. Seifert	755 Ryland Ave., Reno
New Hampshire	June 16-19	Whitefield	F. E. Williams	814 Elm St., Manchester
New Jersey	May 12-15	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 19-22	Albuquerque	J. S. Eilar	7 Medical Arts Sq., N.E. Albuquerque
New York	May 20-22	New York	C. A. Wilkie	1 Hanson Pl., Brooklyn 17
North Carolina	May 5-8	Pinehurst	L. H. Butler	Jefferson Bldg., Greensboro
North Dakota			J. H. Pfister	419½ Dakota Ave., Wahpeton

State	Date	Place	Secretary	Address
Ohio	Oct. 6-9	Columbus	E. G. Jones	185 E. State St., Columbus
Oklahoma			S. A. Russman	1219 Classen Dr., Oklahoma City
Oregon	Mar. 3-5, 1958	Portland	T. D. Holder	Selling Bldg., Portland
Panama Canal Zone			A. L. Robertson	5700 USAF Dispensary, Albrook Air Force Base
Pennsylvania	May 23-25	Harrisburg	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico	January 1958		R. Borges	Box 843, Arecibo
Rhode Island	January 1958	Providence	W. F. Decesare	216 Broadway, Providence
South Carolina	May 12-14	Myrtle Beach	J. E. Wallace	1420 Gregg St., Columbia
South Dakota	May 12-15	Watertown	R. E. Decker	Box 308, Parker
Tennessee	May 13-16	Gatlinburg	A. M. Ballentine	215 W. Flower St., Pulaski
Texas			W. Ogle	3707 Gaston Ave., Dallas 10
Utah	May 23-25	Salt Lake City	R. C. Dalgleish	State Capitol Bldg., Salt Lake City
Vermont	May 26-28	Manchester	E. H. Van Santvoord	22 Washington St., Rutland
Virginia			W. T. McAfee	Colonial National Bank Bldg., Roanoke
Washington			W. P. Brust	211 Medical & Dental Bldg., Seattle
West Virginia	July 21-24	White Sulphur Springs	G. N. Casto, Jr.	710½ Lee St., Charleston
Wisconsin			H. O. Hoppe	1331 W. Vliet St., Milwaukee
Wyoming	June 13-15	Sheridan	T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama	June 9-14* June 10, 11†	Birmingham	W. L. McCarty	Professional Center, Montgomery
Alaska	July 9-12*†	Anchorage	R. H. Williams	Box 2122, Juneau
Arizona	June 24-28* June 26†	Florence	W. G. Biddulph	1502 W. Osborn Rd., Phoenix
Arkansas	June 17-21	Little Rock	W. T. Jones	107 E. Shelton, Monticello
California	June 24 July 29	Los Angeles San Francisco	D. R. Grant	407 Post St., San Francisco
Colorado	June 24-28‡		R. F. Gilmore	Republic Bldg., Denver 2
Connecticut	June 24-26* June 28, 29* June 27-29†	Boston Bridgeport Bridgeport	C. G. Brooks	302 State St., New London
Delaware	June 24*† June 25-27*†	Philadelphia Wilmington	P. K. Musselman	143 W. Main St., Newark
District of Columbia			W. T. Birthright	1835 Eye St., N.W., Washington
Florida	July 8-18*†	Jacksonville	R. P. Taylor, Jr.	P. O. Box 2913, Jacksonville 3
Georgia			W. G. Brown	Blackshear
Hawaii	Aug. 29-Sept. 2*†	Honolulu	J. Y. Ing	210 James Campbell Bldg., Honolulu
Idaho	June 17-19	Boise	A. G. DeWinter	Sun Bldg., Boise
Illinois	June 25-28*†		W. A. McKee	Wood Bldg., Benton
Indiana	June 11-14*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	May 27-31*†	Iowa City	P. A. Hahn	Farmers & Merchants Bank Bldg., Burlington
Kansas	June 3-6	Kansas City, Mo.	G. L. Teall	Box 71, Hiawatha
Kentucky	June 10-13*†	Louisville	J. J. Kelly	102 W. Madison St., Franklin
Louisiana	June 2-7‡		R. C. Steib	Maison Blanche Bldg., New Orleans
Maine	June 17-19	Boston	A. S. Appleby	Box 260, Skowhegan
Maryland	June 10-12‡		H. Levin	3429 Park Heights Ave., Baltimore 15
Massachusetts	June 18-21*‡ June 20, 21†‡		A. M. Bommer	349 Broadway, Revere
Michigan	June 9-15	Ann Arbor	J. L. Champagne	3714 W. McNichols Rd., Detroit 21
Minnesota	June 17-21*†	Minneapolis	M. G. Walls	Lowry Bldg., St. Paul
Mississippi	June 18-20*†	Jackson	J. C. Boswell	Medical Arts Bldg., Jackson
Missouri	June 10-15, 17, 18* June 10, 13, 17, 18†	Kansas City	R. R. Rhoades	Central Trust Bldg., Jefferson City
Montana			R. O. Betzner	303 Power Block, Helena
Nebraska	June 10-14	Lincoln	H. E. Weber	Stuart Bldg., Lincoln
Nevada	June 24	Reno	A. A. Cozzalio	130 N. Virginia, Reno
New Hampshire	June 20, 21* June 20†	Boston	S. G. Markos	8 Renaud Ave., Dover

State	Date	Place	Secretary	Address
New Jersey	June 10, 11*	Philadelphia	C. J. Schweikhardt	150 E. State St.,
	June 14, 15*	Trenton		Trenton 8
	June 18, 19*	New York		
	June 26, 27*	Philadelphia		
	May 31, June 1†	Teaneck		
New Mexico	June 24-27	Santa Fe	J. J. Clarke, Sr.	Artesia
New York	July 1, 2, 9-12*‡		D. W. Beier	23 S. Pearl St.,
	July 1, 2, 9, 10†‡			Albany 7
	Dec. 10-13*‡			
North Carolina	June 24*†	Chapel Hill	J. H. Guion	Doctors Bldg., Charlotte 7
North Dakota	July 8-12	Fargo	T. M. Flath	312 Main St., Williston
Ohio			H. B. Smith	322 E. State St., Columbus 15
Oklahoma	June 17-19*	Oklahoma City	W. E. Cole	2420 N. Meridian,
	June 17, 19†			Oklahoma City
Oregon	June 10-13*†	Portland	F. L. Utter	Pioneer Trust Bldg., Salem
Pennsylvania	June 16-21*	Philadelphia	R. E. V. Miller, Sr.	Dept. of Public Instruction,
	June 16-19†	Pittsburgh		Box 911, Harrisburg
Puerto Rico			J. Mercado C.	Comercio St. #452,
				San Juan
Rhode Island			F. M. Hackett	267 Academy Ave.,
				Providence
South Carolina	June 13-15	Columbia	J. L. Gunter	1226 Pickens St., Columbia 1
South Dakota	June 23-26*†	Sioux Falls	H. T. Aker	Canton
Tennessee	June 10-15	Memphis	C. R. Alta	Bennie-Dillon Bldg.,
				Nashville
Texas	June 1-8*	Houston	R. T. Weber	Capitol National Bank
	June 1-4†			Bldg., Austin 16
Utah	June 24-30‡		A. Ridge, Jr.	10 S. Second E., Provo
Vermont	June 24-26*†	Burlington	P. M. Fitch	Newport
Virginia	June 10-15*	Richmond	J. M. Hughes	Medical Arts Bldg.,
	June 10, 11†			Richmond
Washington	June 24-27	Seattle	F. S. Rotchford	1108 S. Washington St.,
				Olympia
West Virginia	June 24-26	West Liberty	C. C. Cottrill	Box 111, Glen Rogers
Wisconsin	June 3-7*†	Milwaukee	S. F. Donovan	Tomah
Wyoming			W. A. Hocker	O & S Bldg., Casper

Most states require applications to be in 30 days prior to examination date.
*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	Apr. 28-May 4	Columbus, Ohio	I. L. Furnas Secy.	928 Silverado St., La Jolla, Calif.
American Academy of Dental Medicine	May 29-31	Boston	G. J. Witkin Secy.	45 S. Broadway, Yonkers, N.Y.
American Academy of Gold Foil Operators	Nov. 1, 2	Miami, Fla.	R. B. Wolcott Secy.	Navy Dental Tech. School, Naval Training Center, San Diego, Calif.
American Academy of Implant Dentures	Nov. 2-4	Miami, Fla.	P. S. Loechler Secy.	340 N. California, Stockton, Calif.
American Association of Dental Examiners	Nov. 1, 2		C. A. Bumstead Secy.	Stuart Bldg., Lincoln, Neb.
American Association of Orthodontists	May 13-16	New Orleans	R. E. Shephard Secy.	8230 Forsyth Blvd., St. Louis
American Board of Pedodontics	July 25-27	San Francisco	R. L. Ireland Secy.	College of Dentistry, University of Nebraska, Lincoln 8, Neb.
American College of Dentists	Nov. 3	Miami Beach, Fla.	O. W. Brandhorst Secy.	4221 Lindell Blvd., St. Louis 8
American Dental Society of Europe	Aug. 28-31	Lausanne, Switzerland	J. P. Molony Secy.	110 Harley St., London W. 1, England
American Denture Society	Nov. 1-3	Miami Beach, Fla.	V. L. Steffel Secy.	College of Dentistry, Ohio State University, Columbus, Ohio
American Society of Oral Surgeons	Oct. 30-Nov. 2	Miami Beach, Fla.	A. B. Coxwell Exec. Secy.	1976 Douglass Blvd., Louisville 5, Ky.
Berkshire Conference in Oral Pathology and Periodontology	June 16-20	Lenox, Mass.	I. Glickman Dir.	Tufts University, School of Dental Medicine, 136 Harrison Ave., Boston 11
British Columbia Dental Association	May 16-18	Victoria, B.C., Canada	D. Parfitt	Medical Dental Bldg., Vancouver, B.C., Canada
British Dental Association	July 1-5	Newcastle on Tyne, England	H. P. Buchanan Secy.	13 Hill St., Berkeley Square, London W. 1, England

Name	Date	Place	Secy. or Chm.	Address
Canadian Dental Association in co-operation with Western Canada Dental Society	June 23-26	Winnipeg, Canada	D. W. Gullett Secy.	Canadian Dental Association, 234 St. George St., Toronto 5, Ont., Canada
Chicago Dental Society	Feb. 2-5, 1958	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Cleveland Dental Society	May 6-8	Cleveland	L. H. Samartini Gen. Chm.	710 Carnegie Hall Bldg., Cleveland 15
Council on Dental Education, Dental Aptitude Tests	Oct. 4, 5		S. Peterson Secy.	222 E. Superior St., Chicago
European Organization for Research on Fluorine and Dental Caries Prophylaxis, Fourth Meeting	June 8-10	Malmo, Sweden	H. J. Schmidt	Obere Weinsteige 5, Stuttgart-Degerloch, Germany
Federation Dentaire Internationale 45th Annual Meeting	Sept. 6-14	Rome, Italy	G. H. Leatherman Secy. Gen'l	35, Devonshire Pl., London, W.1., U.K.
Fifteenth Congres Francais de Stomatologie	Sept.	Paris, France	J. Bara Gen. Secy.	30, Ave. Felix Faure, Paris 15, France
National Board of Dental Examiners	Dec. 2, 3		G. J. Casey Secy.	222 E. Superior St., Chicago
National Dental Association	Aug. 4-8	Hot Springs, Ark.	J. A. Jackson Secy.	P.O. Box 197, Charlottesville, Va.
New England Dental Society	Oct. 16, 17	Boston	F. L. Finley, Jr. Secy.	43 Farmington Ave., Hartford, Conn.
Northwest Academy of Dental Medicine	May 12-16	Sun Valley, Idaho	G. Underwood Secy.	Selling Bldg., Portland 5, Ore.
Norwegian Dental Association, Annual Meeting	Oct.	Oslo, Norway	K. Gard Secy.	Incognitogatan 17, Oslo, Norway
Pacific Coast Dental Conference	Aug. 19-22	San Diego	C. W. Gilman Secy.	219 E. 8th St., National City, Calif.
Pacific Coast Society of Prosthodontists	Aug. 15-17	San Diego	A. W. Spaulding Secy.	4350 11th Ave., Los Angeles 8
Societe Suisse d'Odontologie, Annual Congress	May 31-June 2	Bürgenstock, Switzerland	Secretary	Spitalgasse 37, Berne, Switzerland
Southeastern Society of Oral Surgeons	May 9-11	New Orleans	J. E. Skaggs Secy.	Francis Bldg., Louisville 2, Ky.
Third International Medical and Surgical Meetings—International Medical and Health Exhibition	June 1-9	Turin, Italy	B. Roccia Dir.	Dentistry Clinic, University of Turin, Corso Polonia 2, Turin, Italy
Twelfth International Dental Congress	Sept. 7-14	Rome, Italy	P. Lalli Secy. Gen.	Via Boezio 16, Rome, Italy
U.S.C. Dental Study Group of Mexico Tenth Annual Seminar	May 12-16	Tehuacan, Puebla	R. M. Ruff	Niza No. 6, Mexico 6, D.F.

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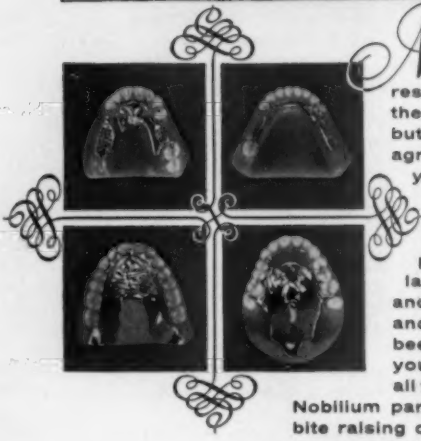

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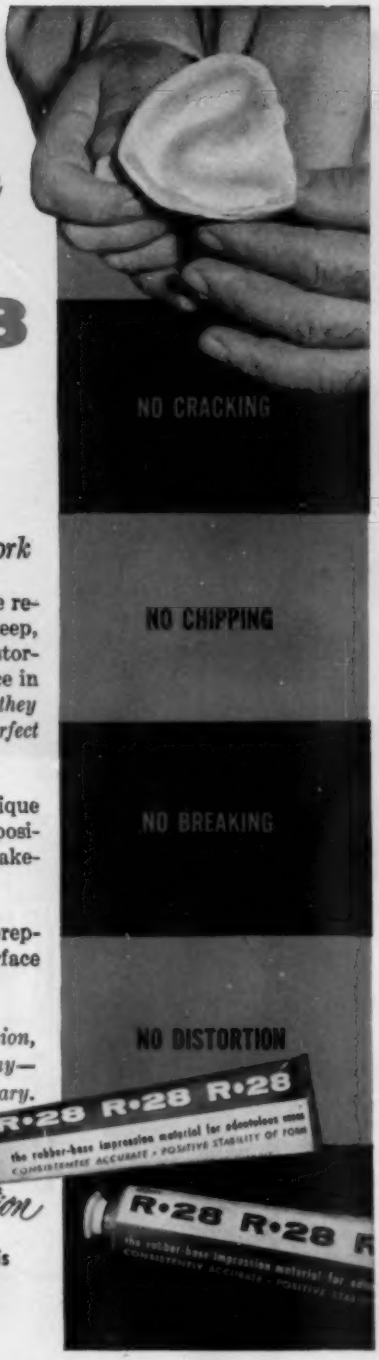

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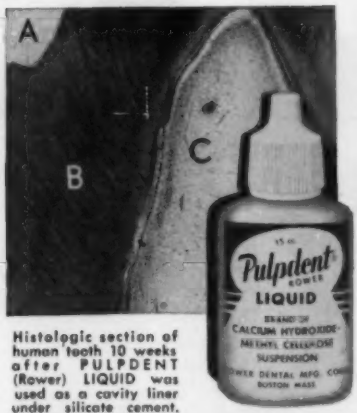

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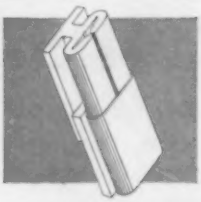

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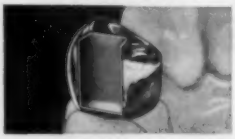

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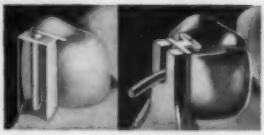

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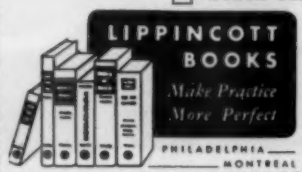

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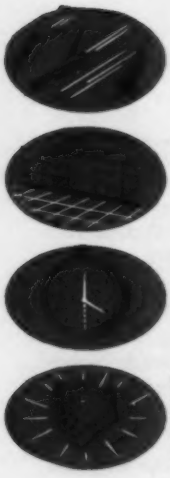

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1. Martin, E.A.: Roberts' Nutrition Work with Children, Chicago, University of Chicago Press, 1954, p. 53.
2. Sebrell, W.H.: Developing Modern Nutrition Programs, Public Health Reports, United States Department of Health, Education and Welfare *69*:277 (Mar.) 1954.
3. Joint Report of the Council on Dental Health and the Council on Dental Therapeutics of the American Dental Association: Sugar and Dental Caries: The Effect on the Teeth of Sweetened Beverages and Other Sugar-Containing Substances, J. Am. Dent. A. *47*:387 (Oct.) 1953.

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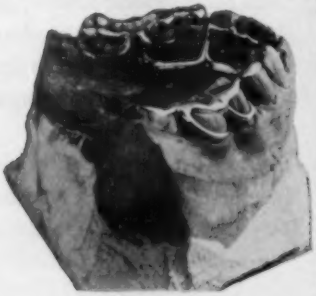

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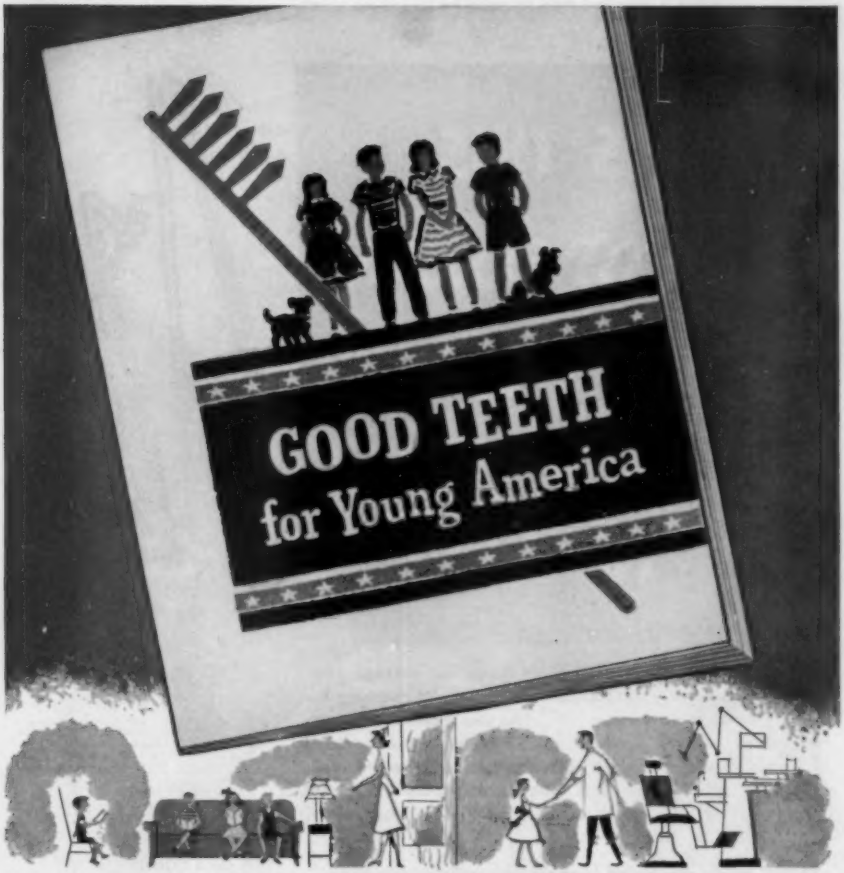

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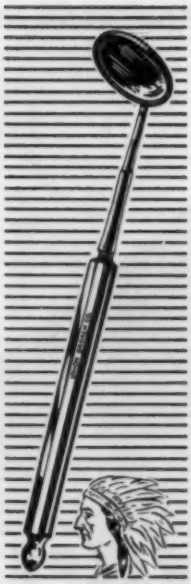

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It has been estimated that the average dentist sees at least six or eight dental periodicals each month—many even see more. The word "see" is used advisedly because it is difficult for the average dentist to get the time to read that many magazines carefully.

In fact, many magazines never get more than a cursory reading, if that. This is not because the dentist doesn't have the interest; he simply lacks the time. The demands of practice in 1957 are too great.

Fortunately, the American Dental Association, recognizing the need for a mechanism to enable the dentist to keep abreast of advances in dental science, established in 1956 a new monthly magazine to accomplish this purpose. It is called *Dental Abstracts*.

It is the stated purpose of *Dental Abstracts* to:

1. Present a selection of pertinent literature representing various points of view within the profession;

2. Provide, by a few hours' reading each month, a survey of the significant advances being made by dentistry throughout the world, as reflected in current dental literature; and

3. Supply enough data in each abstract so that the reader may determine whether he wishes to refer to the original article for more complete information.

The abstracts are grouped as follows: Orthodontics and Pedodontics, Armamentarium, Periodontics and Endodontics, Prosthetic Dentistry, Operative Dentistry, Professional Activities, Basic Science, Oral Surgery, Preventive and Public Health Dentistry and Doctoral and Masters' Dissertations.

Readers of *Dental Abstracts* can organize their reading selectively and read desired articles in less time and with greater profit.

Every important dental periodical in the world is studied for abstract material. Currently 200 magazines, printed in 17 languages, are supplying the basic material for *Dental Abstracts*.

The original articles may be borrowed from the Association when more information than appears in an abstract is desired.

Subscriptions to *Dental Abstracts* should be addressed to the Subscription Department, Desk 26, American Dental Association, 222 East Superior Street, Chicago 11, Illinois. U. S. subscriptions are $6.00 a year. Subscriptions from abroad are $7.00 a year.

Hotel reservation application

98TH ANNUAL SESSION
AMERICAN DENTAL ASSOCIATION
NOVEMBER 4-7, 1957
MIAMI—MIAMI BEACH
FLORIDA

Reservations may be made for accommodations in hotels in three different sections of the Greater Miami Area; Miami, Miami Beach and Bal Harbour. The hotels in each section are listed in order of location reading from north to south, *e. g.*, top to bottom. The approximate time required to travel between the hotels and the Dinner Key Auditorium in Miami is indicated for each section. The scientific session and exhibits will be held in the Dinner Key Auditorium in Miami. The House of Delegates will meet in the Fontainebleau Hotel in Miami Beach.

All reservations for accommodations in any of the hotels listed may be made by completing this application and mailing it to the A.D.A. Housing Bureau, Box 1511, Miami Beach, Florida. Be sure to indicate your arrival and departure time. Reservations will be held until 6 p.m. of the day of arrival unless special arrangements are made with the hotel.

Names of all persons who intend to occupy the accommodations must be listed. List four choices of hotels. Confirmation will be sent to the applicant by the hotel which has accepted the reservation. Please write the A.D.A. Housing Bureau in Miami Beach if you wish to cancel the reservation.

A.D.A. HOUSING BUREAU • BOX 1511, MIAMI BEACH, FLORIDA

(Please print or type) A.D.A.

Applicant:

Name _____ _____

_____
(Street address) (City) (Zone) (State)

Arriving _____ a.m. p.m. Leaving _____

Accommodations:

Hotel _____ Hotel _____
(First choice) (Third choice)

Hotel _____ Hotel _____
(Second choice) (Fourth choice)

☐ Single occupancy, rate to range from $_____ to $_____ per day.
☐ Double occupancy, double bed, rate to range from $_____ to $_____ per day. } 2 names must
☐ Double occupancy, twin beds, rate to range from $_____ to $_____ per day. } be listed below
☐ Suite of _____ rooms, including parlor, rate to range from $_____ to $_____ per day.

Occupants: (use an extra page for listing additional names if necessary)
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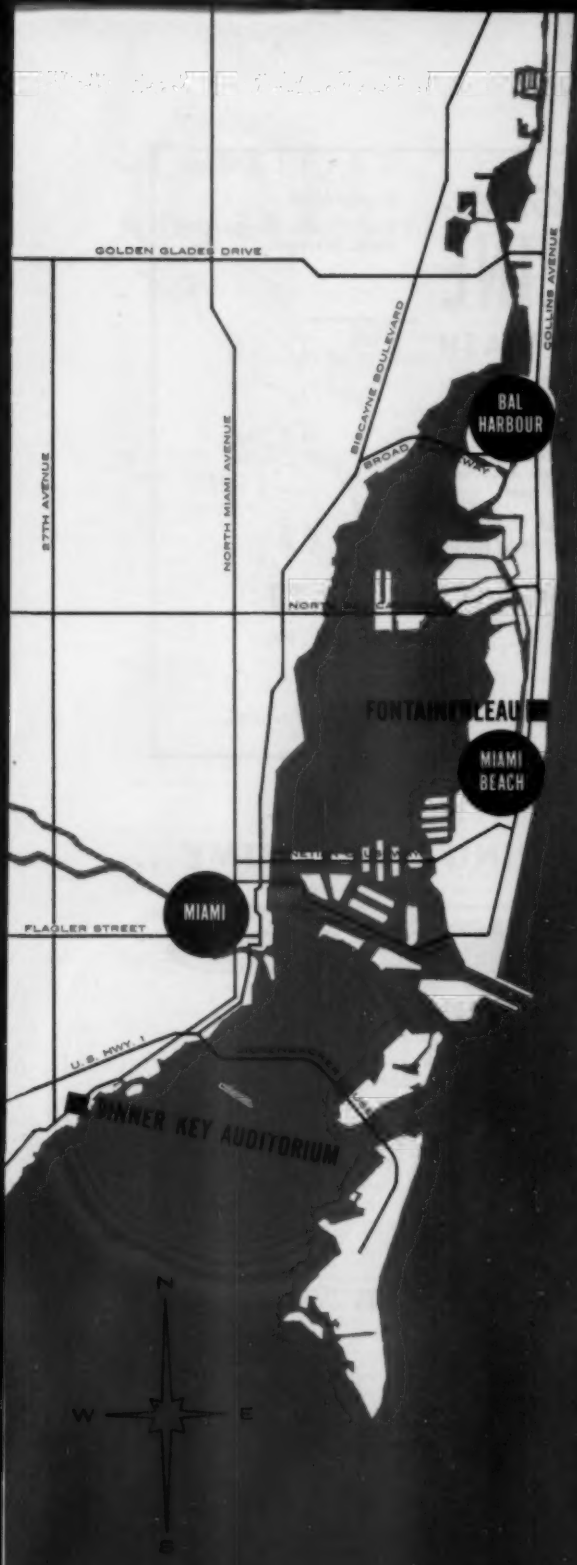

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Continental	5.00- 6.00	6.00- 7.00
President Madison	9.00	11.00
Caribbean	8.00	8.00-10.00
Shoremede	8.00	10.00
Saxony	8.00	10.00-16.00
Sea Isle	10.00-12.00	12.00-16.00
Seville		10.00-16.00
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Roney Plaza	8.00-12.00	10.00-16.00
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Pickwick	8.00-12.00	10.00-14.00
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CALIFORNIA—For rent. Dentist's office and home, where prominent dentist practiced for 23 years; located in center of fast growing community. 6161 Lincoln, Anaheim, Calif. Call Madison 5-2849 or at 6650 Lincoln.

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ILLINOIS—For sale or rent. Completely equipped dental office with two chairs and laboratory, including individual office building and parking facilities. Death of prominent local dentist leaves vacancy in Kankakee, Ill. Flexible terms for either purchase or rent. Write or call Ada R. Kratz, 1340 Maple, Kankakee, Ill., or Ray M. Foreman, 708 Baum Bldg., Danville, Ill.

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IOWA—Clinton. Practice for sale, because of recent death of dentist established in community for 18 years. All modern equipment. Ritter Model D x-ray, Ritter Tri-dent B unit, Ritter motor chair, American cabinet, all cream white—excellent condition. Fully equipped laboratory with model trimmer and all prosthetic equipment in best professional building in town. Reasonably priced for immediate sale. Terms can be arranged. Mrs. G. D. Walrath, 517½ Argyle Court, Clinton, Iowa.

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MICHIGAN—For sale. Upper peninsula. Ideally located lake front home and two chair modern, equipped office. Good practice in prosperous city of 13,000. Ideal boating, hunting and fishing. Generous terms. Address A.D.A. Box No. 580.

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NEW JERSEY—Monmouth County. For sale. Two chair, air-conditioned office. Rent $70 per month. Established 15 years. Active. Moving out of state. $4,800 for immediate sale. Address A.D.A. Box No. 588.

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WASHINGTON—Foreign missionary work. Excellent opportunity for qualified men in all parts of the world. For details apply to The Missionary Dentist, 5543 35th Ave., N.E., Seattle 5.

WISCONSIN—Dentist for general practice in eastern Wisconsin. 4,000 population. Surrounded by small towns and center of rich agricultural area. Near industrial center and lake region. Modern office available. Address A.D.A. Box No. 610.

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ARKANSAS—Dental hygienist. Salary and commission. New modern office. Present hygienist left in April. Reason: Marriage. Call or write Dr. Charles L. Craig, 526 Chickasawba Ave., Blytheville, Ark. Phone POplar 3-6881.

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IDAHO—Dental hygienists needed in Idaho. Class I, salary $310 to $385 per month; Class II, $325 to $425. For information, qualifications, contact William J. Hilty, personnel officer, State Board of Health, Boise, Idaho.

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MARYLAND—Silver Spring. Five day week. Opportunity for proficient and personable hygienist; guaranteed salary plus commission. Sick leave, two weeks' vacation plus other benefits of a permanent position. Address A.D.A. Box No. 629.

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MICHIGAN—Dental hygienist. Kalamazoo Health Department. Salary, $4,160. Assist dentist in public health dental program. 40 hour work week. Social security, hospital insurance, vacation, sick leave benefits. Write the Dental Director, Health Dept., City Hall, Kalamazoo, Mich.

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VIRGINIA—Dental hygienist. Roanoke—lovely city of over 100,000. Young dentist, nice office away from downtown area. Need not treat patients all day. Salary. Address A.D.A. Box No. 611.

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Oral surgeon, 30 years of age, married, veteran. Three years', A.D.A. approved, excellent graduate training; desires association or teaching in oral surgery. Will take any state board. Available July 1957. Address A.D.A. Box 630.

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Ohio and Florida licensed dentist with internship and service completed in August, desires to purchase established practice. Age 30, married, experienced, reliable, ethical. Prefer medium sized city or suburban location. Address A.D.A. Box No. 631.

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Am 40 years old, licensed in Florida and New Hampshire, and looking for a very lucrative practice. Have been in present location in Middle Atlantic state for 10 years, and at 4½ days a week gross $35,000 with low fees. I would like to buy outright, assume partnership, or join an over-worked man who needs an associate of impeccable integrity. Am best at production work in general dentistry, but also proficient in occlusal reconstructions. Excellent background in laboratory work, including steel. Would also consider overseas location. Six years' World War II, available for personnel interview anywhere. Address A.D.A. Box No. 632.

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California licensed. Orthodontic preceptorship wanted in Los Angeles area. 1949 graduate, married, with family. Considerable pedodontics, some orthodontic training and experience during six years' civilian practice. Military service completed July 1957. Address A.D.A. Box No. 613.

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Pennsylvania licensed dentist interested in purchasing active practice, association, or partnership in suburb or small town near Philadelphia. Age 28, married, completing military obligation July 1957. Thoroughly experienced in all phases of dentistry. Address A.D.A. Box No. 614.

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New York, Connecticut licensed. Completing military service July. Seeking promising location or association. Good background and training. Hospital internship. Special qualifications in restorative dentistry, pedodontics. Address A.D.A. Box No. 615.

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Dentist, Pennsylvania licensed, desires association or to purchase ethical office complete, in Pittsburgh or Philadelphia or their vicinities. Give full details. Confidential. Draft exempt. Address A.D.A. Box No. 616.

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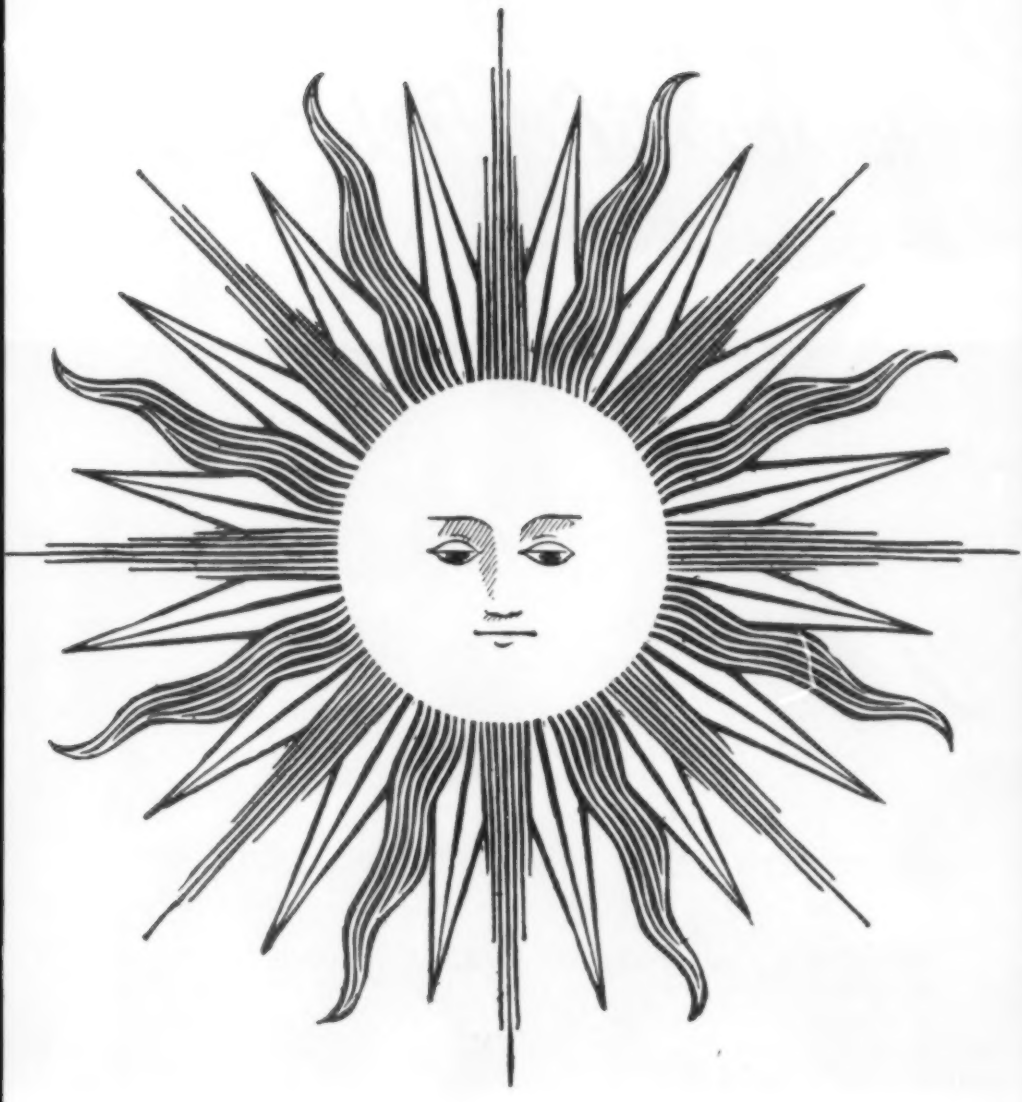

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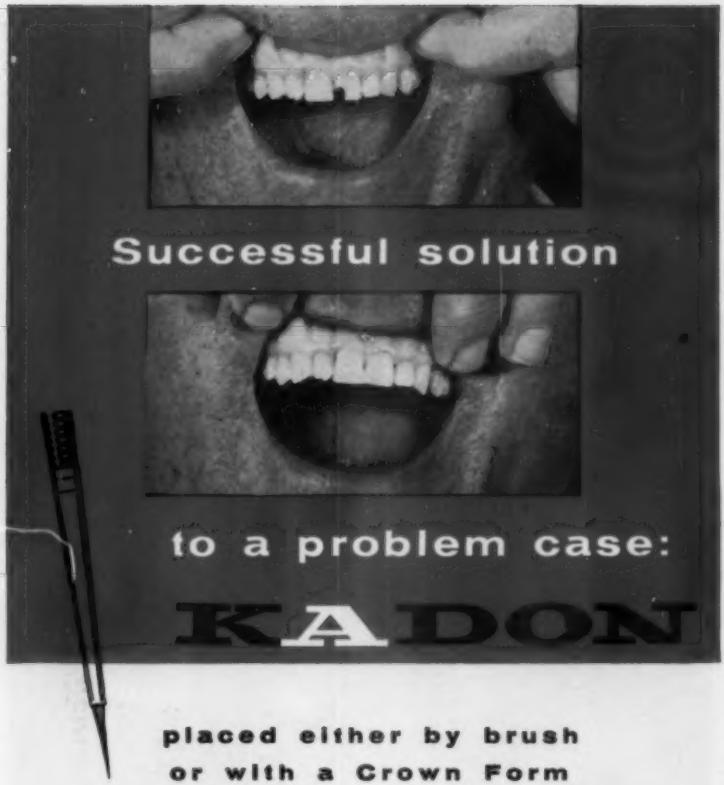

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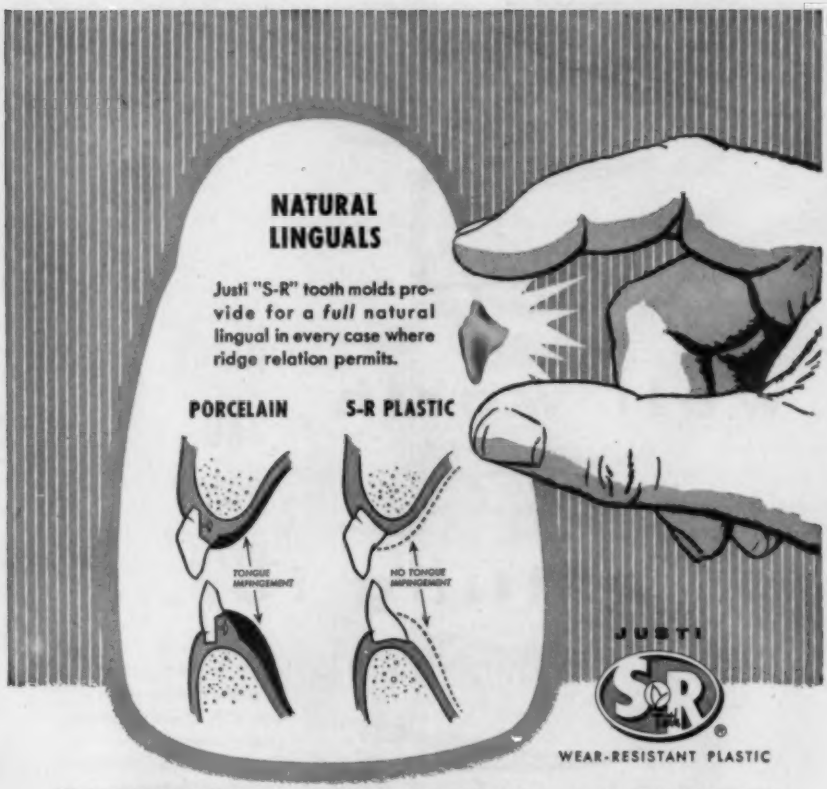

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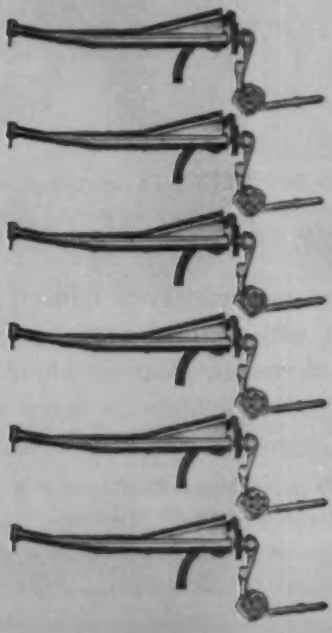

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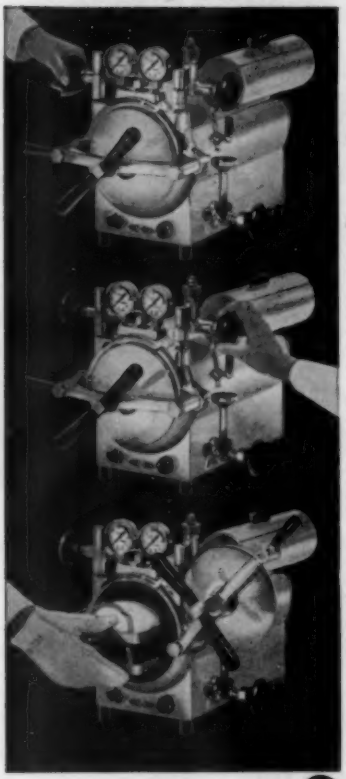

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After loading, simply transfer steam from reserve to sterilizing chamber. In only a few seconds, temperature is attained.

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When sterilization is completed, discharge steam to condenser after closing transfer valve and crack open the door.

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In a minute or two entire contents are removed completely sterile and dry. The autoclave is ready for second load.

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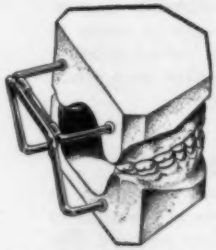

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To mount models, drill 4 holes (template and drill supplied); attach prongs with sticky wax. To remove, heat prongs and pull out; casts are unmarred. These articulators may be used repeatedly.

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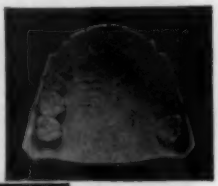

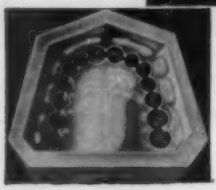

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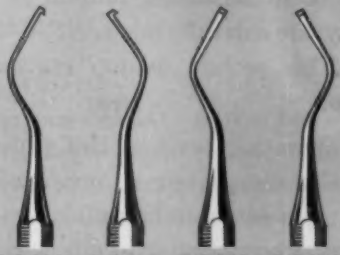
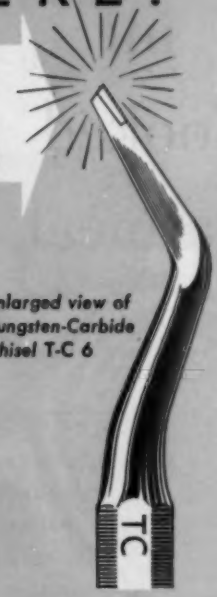


T-C 210 T-C 211 T-C 212 T-C 213

Enlarged view of Tungsten-Carbide Chisel T-C 6



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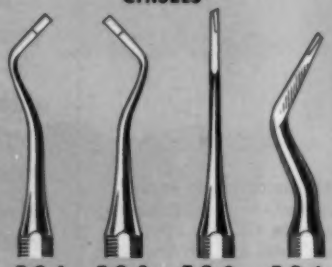

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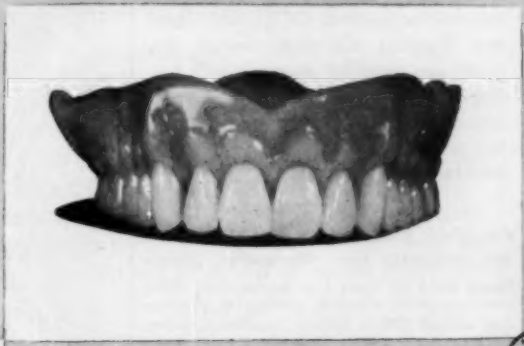

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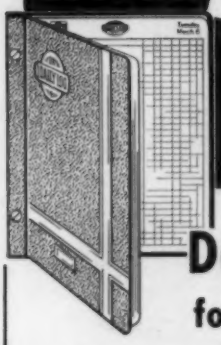

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High Speed Hysteria and the Dental Profession's Dilemma

BY L. M. DANGERFIELD

Vice-President, Bowen & Company, Inc.

• • Ever since the principle of High Speed was advanced nearly a decade ago, the advantages over conventional handpiece operation have been lost in the fictitious illusion that higher and still higher RPM speeds were necessary. As a result there is considerable confusion in the minds of the Profession as to what constitutes optimum speed—is it 25,000 . . . 45,000 . . . or in the fantastically high ranges of the 150,000 and more RPM's?

It might be well, at this time, to consider the motivations behind the development of High Speed.

A group of Dentists—representing the highest authorities for Testing and Research for the Profession— reasoned that patient discomfort at the chair was directly related to heat and vibration caused by the cutting instruments against the tooth.* Various interim devices, developed for the conventional handpiece unit to step up RPM speeds, left much to be desired for the ideal result.

It was obvious that a completely new handpiece would have to be designed and engineered; one that would provide increased patient comfort with maximum *safety* and *efficiency* for the Dentist. Three types of energy were open to investigation: 1) Mechanical, 2) Ultrasonic and 3) Turbine.

Sound Engineering knowledge, backed by thorough testing evidence, dictated the adoption of the turbine principle of propulsion for the new handpiece. For the next several years, countless experiments in propulsion media (air, oil, glycerine, water, etc.) and rotating speeds were conducted, investigated and discarded until the optimum combination was finally determined—hydraulic propulsion and the turbine principle at 45,000 RPM. At this speed, cutting is efficient . . . the patient comfortable . . . the Dentist operates with safety.

It is significant to note that mechanical handpieces were discarded because speeds in excess of 80,000 RPM were needed to produce minimal vibration . . . air driven handpieces required 150,000 RPM for sufficient torque . . . ultrasonic handpieces posed the psychological problem of sensory dexterity and digital control.

Once the optimum principles of hydraulic propulsion and 45,000 RPM speed were determined, Bowen & Co. Inc., long acknowledged leaders in the manufacture of precision scientific laboratory equipment, were chosen to build the new handpiece. It was first presented to the Profession in 1955 as the TURBO-JET. Although it was a completely new principle of handpiece operation more

*Nehen, Robert J., Pelander, Carl E.; Kumpula, John W. "Hydraulic Turbine Contra-Angle Handpiece." J.A.D.A. 47:324-329 Sept. 1953. (Available upon request)

than 1300 are now in daily use—eloquent testimony of their acceptance by the Profession.

In the nearly two years of use in all parts of the Country it is interesting to note how Patients and Dentists alike have been quick to record their amazement and delight as evidenced by the many articles appearing in the Lay Press and letters of approval sent to the Manufacturer from which we except the following:

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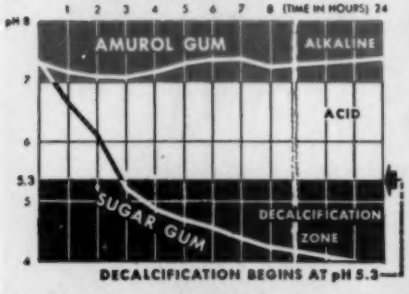

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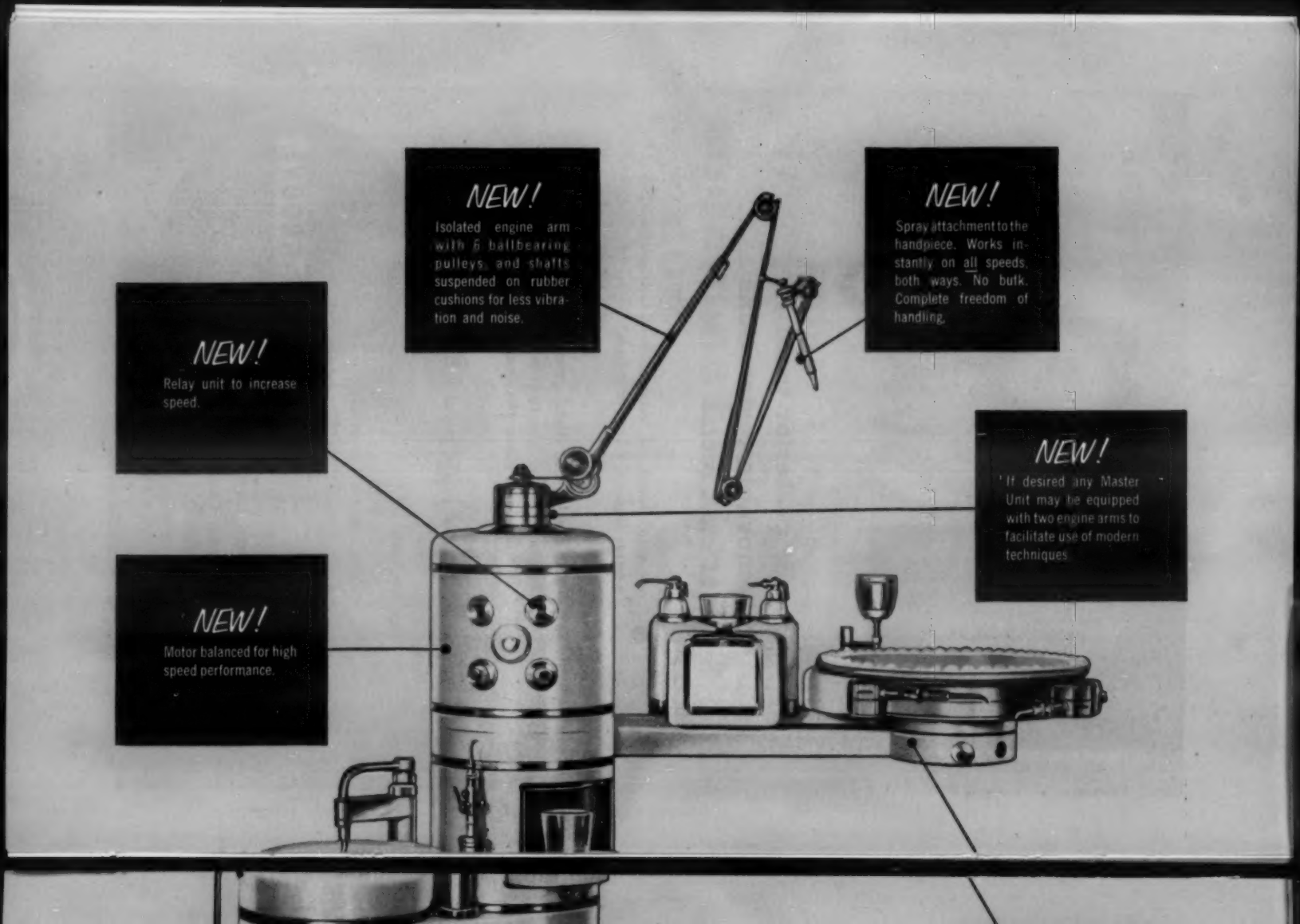
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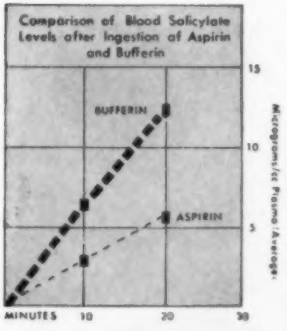

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